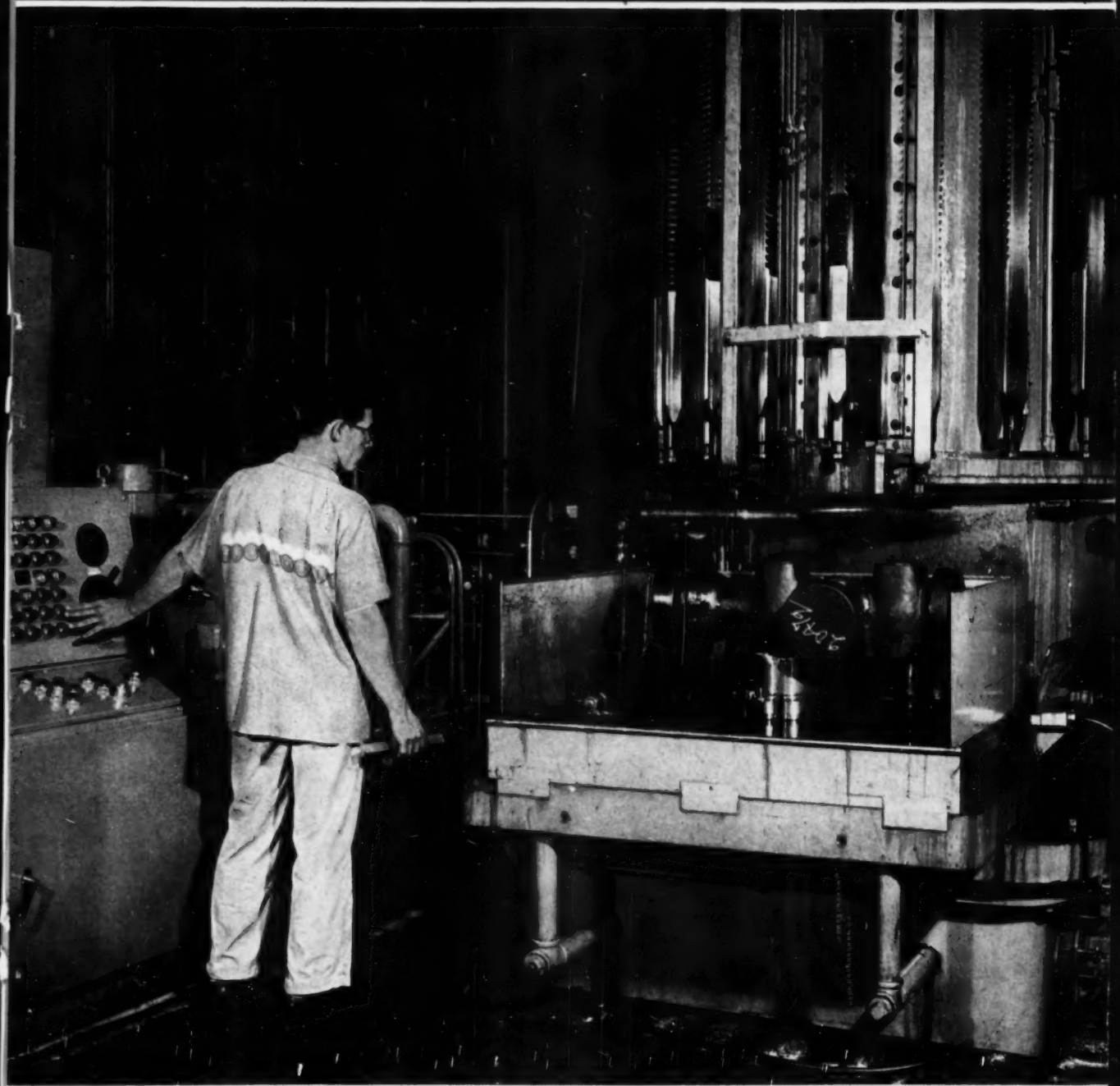
American Machinist

JULY 27, 1959 75¢

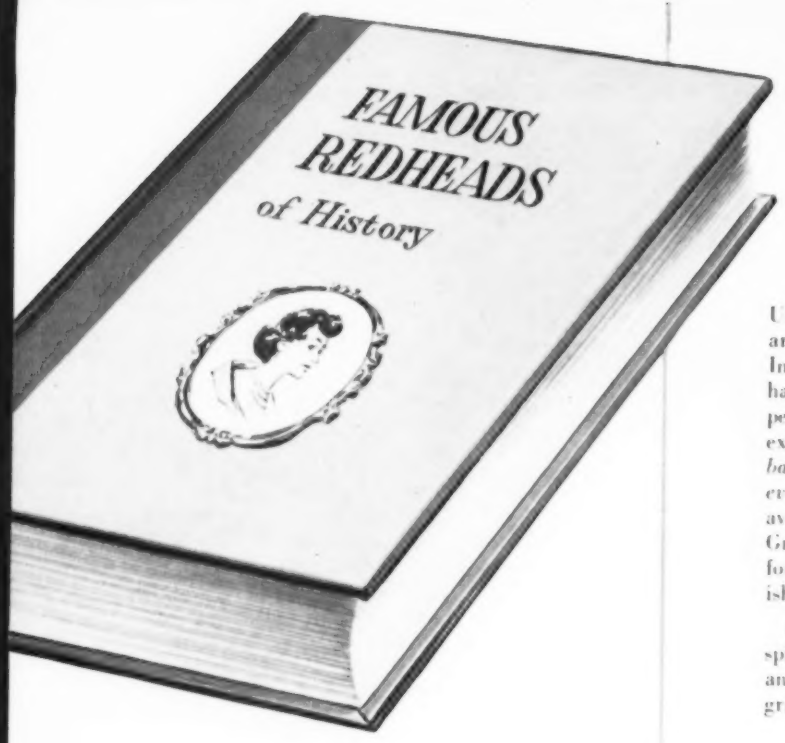
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Heat and Speed Form Titanium

see page 108



Turret broach "builds" hole with multiple cuts—see page 94



in the past...

Throughout the ages, redheads have acquired a reputation for being glamorous, adventurous, unpredictable and often temperamental—greatly admired or greatly envied. Cleopatra, Queen Elizabeth, Madame Pompadour, Mary Queen of Scots, Lady Hamilton, Nell Gwynn, Madame Dubarry, Sarah Bernhardt—some of history's most tempestuous titian-haired beauties undoubtedly contributed to this fame.

In literature, too, redheads have often been cast in similar roles—like Nana, Sadie Thompson, Becky Sharpe and Scarlett O'Hara, to mention just a few.

The relationship between hair coloring and personality may have been sheer coincidence. But the fact remains that redheads usually stand out from the crowd in more than appearance alone.

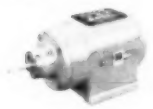
RED HEAD
HEALD

in the present...

Unlike their feminine counterparts, Heald Red Heads are *not* temperamental and definitely *not* unpredictable. In fact Heald Red Head boringheads and wheelheads have achieved an enviable reputation for dependable performance, based on more than 30 years of operating experience. And today, the Red Head line includes *six basic types*, in sizes, speeds and capacities for virtually *every* metal-working application. Heald Red Heads are available not only for Heald Bore-Matics and Internal Grinders, but also (and many people do not realize this) for use with any similar types or makes of precision finishing machines.

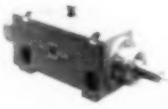
From this complete Red Head line you can select a spindle unit that will help you improve product quality and cut production costs on any boring or internal grinding job.

RED HEAD BELT-DRIVEN WHEELHEADS
Cool-running, permanently lubricated wheelheads for standard belt drive. Sleeve Style, Naked Style and Quill Style heads for speeds up to 10,000 rpm.



RED HEAD HI-FREQUENCY WHEELHEADS
Permanently lubricated or mist lubricated precision wheelheads for Hi-Frequency drive. Naked Style, Quill Style or for mounted point wheels. Speeds up to 100,000 rpm.

RED HEAD HI-SPEED BELT DRIVEN WHEELHEADS
New head design permits small hole grinding at speeds from 45,000 to 100,000 rpm without the need for high frequency generating equipment.



RED HEAD BORINGHEADS
Permanently-lubricated belt-driven boringheads for high-precision Borizing with rotating tools or rotating work. Speeds to 8,000 rpm.; available in a wide range of sizes.

RED HEAD MULTI-SPINDLE BORINGHEADS
Permit simultaneous multiple-hole Borizing with centers as close as ¾". Miniature Precision Red Heads, with common belt drive, mounted in interchangeable precision-bored spindle plates.

RED HEAD BORIZERS
Completely self-contained motor driven, hydraulically powered head units for rotating, feeding and retracting single or multiple tools in automated setups.

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THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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TURN PAGE FOR METALWORKING REPORT →

METALWORKING REPORT

SIGNIFICANT CURRENT DEVELOPMENTS IN TOOLING AND PRODUCTION PROCESSES

CUTTING

Spark Breakout

Developments are coming in from all sides in electrical discharge machining, and it seems probable that the process will be used extensively for die sinking and other operations:

- A complete line of 35 machines for EDM will be introduced by Cincinnati Milling Machine Co in September. All but two of them are built on building-block principles.
- Elox is reported to have a new power supply that uses far fewer tubes, yet has higher output.
- Matson Corp (50% owned by Ingersoll Milling Machine Co) demonstrated its first stock machine on the West Coast last week.
- Ex-Cell-O is reported to be readying a new circuit for the Method X discharge machines.
- Considerable interest has been aroused by the demonstration in New York of a Russian machine with an impulse generator circuit operating at a low cycle rate (for detailed evaluation, see page 92).

The first Matson machine has a 20-amp current supply and is built on a modified Bridgeport milling machine with a 9 x 30-in. table with 12-in. cross travel. The pan will hold work to 15 x 40 in. The machine is said to have half the number of power tubes of previously available EDM equipment. The company plans models for 20, 40, 60 and 100 amps.

Matson expects to market a low-frequency machine that will remove stock at rates comparable to the Russian and Japax machines in about six months. Because low-frequency machines cannot hold close tolerances or produce fine finishes, the unit will be combined with a high-frequency unit for finishing.

Build Your Own Carbide Tools

Carbide can be applied to HSS tools to produce 2-5 times the usual wear by a British development, the Wickman impregnator. This was announced some time ago in England; now is available in the US, distributed by O K Tool Co. The device applies a fine or coarse layer of special carbide from a hand-held stylus —allowing any kind of tool to be treated at its cutting edges. The layer is from 0.0005 to 0.003 in. thick, depending on the setting. The treatment is resistant to shock loads and requires no polishing. Machine costs just under $700.00; is said to cost only pennies to use.

FORMING

Automatic Die Casting

Fully automated die casting is being shown to customer visitors to the new Die Casting Development Center of Cleveland Automatic Machine Co, Cincinnati. A zinc machine operates at 500 shots/hr with a four-cavity die. Automatic casting ejection and conveying, plus fail-safe controls, make full mechanization possible. Lubrication is supplied to both halves of the die at each cycle.

Another machine, for aluminum, demonstrates production of castings by vacuum, by the Morton system. A single-cavity die for an extremely thin-walled part is evacuated before each shot. This system, in addition to automatic ladling, has allowed production at rates over 300 shots/hr.

Die-Cast Engines

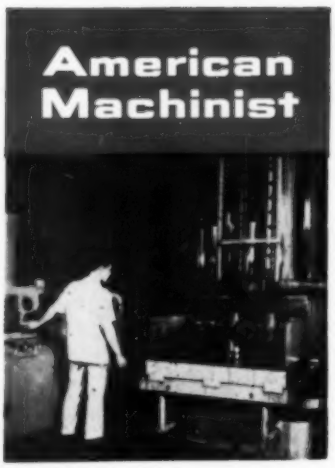
A patent for a die-cast aluminum 8-cylinder engine block was issued to Alfred Bauer, chief engineer of Doehler-Jarvis, on July 7. Work on the new design started back in 1951.

The announcement may be something of an anticlimax, because automotive engineers have denied immediate interest in the design for cars in the next year or two.

Big development money is likely to go instead into a die-cast aluminum 6-cylinder engine block closely paralleling an existing design in cast iron, but modified to cope with thermal expansion and to include suitable water passages. Once these problems are licked, a block weighing about 55 lb should be developed in a short time. A suitable die-casting machine of about 1600-ton rating with fast operating cycle should be no problem for Doehler-Jarvis, considering their successful 2000-ton machine built a couple of years ago.

Forgings by the Yard

Bar is formed into a series or string of automotive parts, ready to be trimmed, by new forging equipment to be exhibited by GFM of Austria at



COVER:
Giant turret broach with built-in programming machines a hole from start to finish by using a number of broaches in sequence. Operator just sets controls to select finished hole size. Installed in the Cameron Iron Works in Houston, Texas, the LaPointe machine has slashed machining time of a hole in an oil field gate valve from 13 hours to 15 minutes. See page 94.

DON'T FORGET . . .

Metalworking Report is not a synopsis of this issue of American Machinist. Major articles are described briefly in the Contents on the page preceding this one. Trends pages are classified by subject and information in them is not repeated elsewhere. Most of the developments in Metalworking Report are so new that further information is not yet available—when it is, you will find a page reference to the article.

the Paris Fair this Fall. The hot-die machines, designated type SHA, operate on standard basic principles with eccentric shafts that make the hammers strike the work.

Rocker arms are made on a small machine. First the bar is hand-located in clamping jaws, with the bar end inside an induction coil. When the bar end is heated to operating temperature, the stock is machine-fed to breakdown and finishing dies progressively. Stock receives three or four blows at each die section, allowing time for a new portion of the bar to heat up. When finished, the bar looks like a string of rocker arms tied together by flash. Production rate is 400 rockers/hr.

Heat, Speed Form Titanium

Heat is critical when titanium is to be formed into high-speed aircraft parts. This is one of several findings by Convair during an extensive development program designed to investigate titanium-forming techniques. One alloy forms easily at 1100 F, producing no springback, for example. Another may form equally well at 1400 F. But in all cases the heat must not be applied too long or the titanium will be damaged, and physical properties will suffer.

This means fast forming is required for most operations. Tools are heated internally and are insulated from the forming machines. So far the best fast operations have been joggling, rolling, drawing, and drop-hammer forming. See p108.

HEAT TREATING

Liquid Pressure Nitriding

Final lab tests are being made on a new method of putting a hard case on nitrided steel parts. A F Holden Co, Detroit, immerses the part in a molten salt, then passes anhydrous ammonia through the bath at 20-40 cu ft/hr at 15 psi. This produces an extremely hard case that is temperature and spall-resistant. The technique saves 8-16 hr in processing time over conventional dry or retort nitriding. It minimized distortion, and it eliminates the "white" layer that usually results from spent ammonia gases. Future applications for liquid pressure nitriding will include aircraft parts.

INSPECTION

Metal Identifier

A portable transistor meter that will identify ferrous and nonferrous metals in mixed parts is now available. The unit will also check the parts for properties such as heat-treated condition, hardness, chemical purity, and presence of decarburization. This makes spark tests and spot tests with chemicals unnecessary.

Measurements are made on any flat surface ⅝ in. in diameter and larger; and the surface may be rough, dirty, or even covered with paint. Time for measurement is 3 sec—a probe is touched to the work. The probe radiates an electromagnetic field that excites eddy currents in the part. The instrument responds to conductivity and permeability of the work, and displays the result on a "heat-check" meter. Two alarm lights are set for tolerance limits.

Plug-in meter scales for various metals and conductivity ranges are supplied by the manufacturer, Mentrol, Inc, Pasadena, Calif. The unit is sensitive to slight alloy differences. Power is battery.

Long-Length Measurement

Pin gages for big parts, such as 20-30 ft in diameter, can be checked against standard dimensions with a new long-length measuring machine introduced by Hilger & Watts, London. The gages are placed against a tailstock, then a measuring headstock plunger is advanced to the other end of the gage. The position of the plunger when it touches the pin gage is read to 0.000,05 or 0.0001 in., according to the quality of headstock fitted, by an optical arrangement that includes 4-in. graduations on the machine base. The machine is a developed-length unit with calibrated scales or tapes.

The equipment will check pin gages to ±0.0001 in./ft of gage length, allowing close tolerances for "match fit" work where these large-size parts must be checked against mating parts of similar size.

Electrochemical Inspection

Any crystalline metal has an electrochemical potential which can be interpreted into data related to hardness, formability, and stresses. Army researchers at Watertown Arsenal made this discovery during basic research to find a non-destructive 100% inspection technique for quality control of sintered parts.

The idea hinges on the fact that the surface energy of a material depends on its surface character—and according to tests, there is excellent correlation between this potential and the strength of sintered parts.

Production-line applications for the principle should help in quality control; and according to a recent study, it is also possible to control physical properties of the metal by controlling the electrochemical potential. This effect may help improve plating methods.

THE OUTLOOK

Metalworking operations are now at a new peak, being two points higher on the American Machinist Index of Metalworking Production than the previous record in 1956. Any serious effects of the steel strike won't be felt until at least mid-August (p83).

WELDING

"Impossible" Joint

Copper can be welded to stainless steel (long considered impossible) with an electrode and procedure developed by International Nickel Co. The company claims strong welds, good penetration, and even contour. For a ⅜-in. butt weld, an 80° V-groove is produced. But just before welding, the copper plate is preheated to 1000 F and the bevel is overlaid with the new "141" nickel electrode ("61" filler wire for Mig and Tig).

After the 40° bevel is restored, the plates are positioned with a root spacing of ⅛ in. and are welded together with the new electrode by conventional technique. The weld should not extend beyond the nickel overlay on the copper. Inco says that chipping out slag is important to weld quality.

Deeper Beam Welds

New possibilities have opened up for electron-beam welding (*AM*—Feb 23 '59, p95). Electrona, Inc (New York), US representative for Carl Zeiss electron-beam equipment, says that a new technique will make welds with a depth-to-width ratio of 20:1.

Principal advantage is that thicker sections can be welded, but another advantage is the extremely narrow heat-affected zone. Former limitation on thickness was between 1/5 and ¼ in. Now, welds have been made over ½ in. thick, and experiments

are currently aimed at a full inch.

The technique does not require more power or any changes in the standard equipment, but the company is not ready to state just how the trick is accomplished.

FINISHING

Electroless Gold Plate

Gold can be plated to any thickness without electric current by a new process developed by EverLubeMetal Finishing Div, N Hollywood, Calif. Up to now, non-electrical immersion processes for depositing gold have been limited to a thickness of only a few molecules. But the new technique allows any desired thickness with complete uniformity on all surfaces. The system is not electrical, nor is it an ion-exchange reaction. Even complex parts previously platable only by electrolysis can be covered.

Improved Hard Chrome

A better plating technique for hard chrome has been introduced by Michrom Inc, Chicago, Ill, a division of Gits Bros Mfg Co. It provides a means of depositing an almost instantaneous film of hard chrome on the base metal, thus eliminating surface corrosion and hydrogen embrittlement. The result is a dense, fissure-free bond of alloy-like strength.

The exceptional throwing power of the technique enables the plate to penetrate every pore of the base metal without buildup on the sharp edges of the pores or surface defects. This results in a dense, void-free surface providing maximum resistance to corrosion, abrasion, erosion, and impact. Tubes, deep holes, recesses, sharp corners, grooves, and blind holes can be plated evenly without buildup.

MATERIALS & COMPONENTS

"Nerve Cell" Static Switch

Latest development in static switches is the Ovitron control unit, an electrochemical switch capable of switching and modulating high amperage ac circuits. Made from simple materials and requiring no precision manufacturing techniques, the unit is competitive with semiconductor static switching devices and relays, yet is less complicated and less subject to wear.

The Ovitron unit, which had its origin in a study of the human nerve cell, has also been tested successfully as a logic device, error detector, modulator, amplifier, and in several other applications. See page 99.

Inflatable Metal Tubing

"Strubing"—strip tubing that can be shipped as ribbon, then inflated at point of use—will be produced in experimental quantities this Fall by Calumet & Hecla, Inc, Allen Park, Mich. Coil lengths up to 15,000 ft will be available, and expanded sizes from thinner than pencil lead up to 8 ft in diameter are planned. The entire ductwork for the heating system for a seven-room house, made of "strubing," could be shipped in a box only the size of an orange crate.

Advantages are the obvious saving in shipping and stockroom space (shipping the wall, not the hole), plus economies in the cold-rolling technique that makes thin-wall tubing in materals and thicknesses that are not available today—or are prohibitive in cost. To solve installation problems, the tubing can be inflated after assembly. Applications are in construction, electric-power, missiles, packaging, and general manufacturing. Inflating requires 50 psi.

MANUFACTURING CONTROL

Automatic Drill Sorting

Fifty-two sizes of small jobber's drills can be segregated at the rate of 6500/hr by a sorting machine developed by Chance Vought Aircraft, Dallas. The machine has four banks of sorting racks, each driven by small electric motors that flip the drills from one sorting station to the next until the drills drop through into the correct size blanks. The "flippers" are small semi-circular disks that are the only moving parts in the machine. All drills are checked twice by the machine before they drop into correct slots. Slip clutches stop each bank if a burred drill jams. Drills are hand fed into the unit, which replaces hand-sorting operations that only attained 3000 drills/day previously. The machine is more accurate than hand sorting, and it results in fewer rejects. Time savings are expected to pay for the machine in a year.

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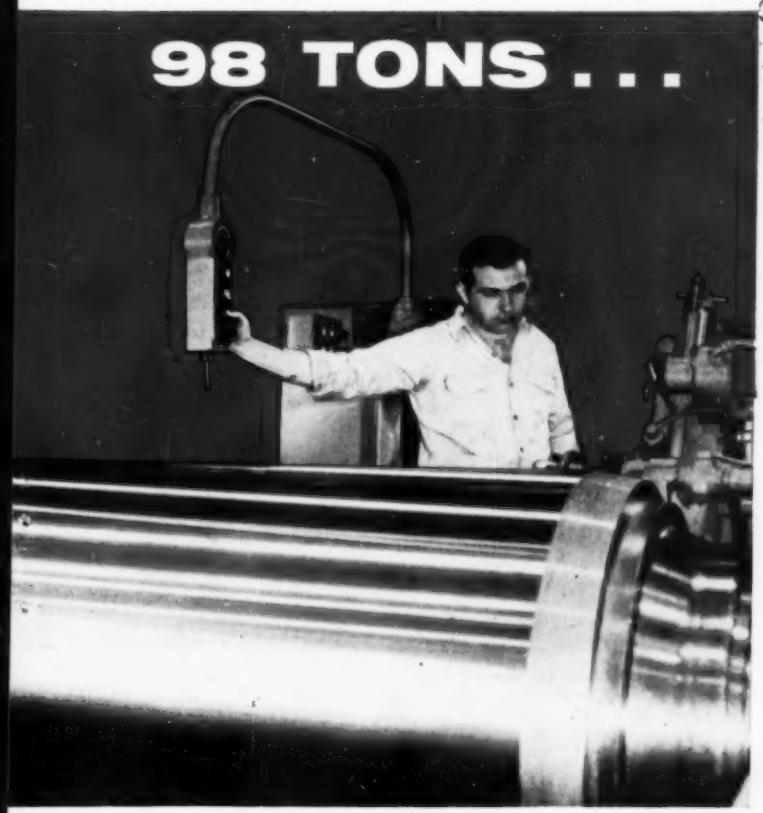

Heavyweight rolls weighing in at 98 tons are precision ground on CINCINNATI FILMATIC Traveling Wheelhead Roll Grinders. *(Photo courtesy Kaiser Aluminum & Chemical Corporation)*

These are familiar working specs for

CINCINNATI FILMATIC Roll Grinders

Just imagine a sheet of steel so thin that a slight breeze could blow it away. This actually can happen to sheets rolled to a thickness of 90 millionths inch (.000090″) on a Sendzimir mill equipped with rolls finish ground on a CINCINNATI 10″ Roll Grinding Machine. At the other extreme, huge ingots, moved by a crane from soaking pits to heavy duty mills, are reduced between rolls ground on a CINCINNATI Traveling Wheelhead Roll Grinder. These machines handle rolls weighing up to 100 tons!

Between these two extremes, the Cincinnati Grinding Machine Division builds several dozen sizes of fine roll grinders. All are equipped with many cost-reducing feature-advantages such as exclusive FILMATIC grinding wheel spindle bearings, which run for years without adjustment or service. Aside from outstanding construction and design details, Cincinnati offers an unusual degree of integration, from the drawing board through foundry, research, machining, assembly, grinding wheels and grinding fluid. Our Roll Grinding Specialists will be glad to give you complete information. And now turn the page for a quick look at various sizes and styles of CINCINNATI FILMATIC Roll Grinders. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

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Builds 10″ to 60″

Small diameter, slender rolls are ground to the highest quality finish and accuracy on CINCINNATI FILMATIC 10″ Roll Grinding Machines.

Grinding a perfect crown on medium-sized rolls of any practical length. The machine for this job is a CINCINNATI FILMATIC 20″ Traveling Table Roll Grinder. *(Photo courtesy Kaiser Aluminum & Chemical Corp.)*

BRIEF SPECS

Sizes and types	Cambering equipment	Catalog
10″, three lengths, traveling table	sine bars	G-714
18″ and 24″, six lengths, traveling table	tilting wheelhead	G-709-1
24″ and 28″ heavy duty, five lengths, traveling table	tilting wheelhead	G-587-1
28″, 36″, 44″, 50″, 60″; eight lengths, traveling wheelhead	tilting wheelhead	G-700

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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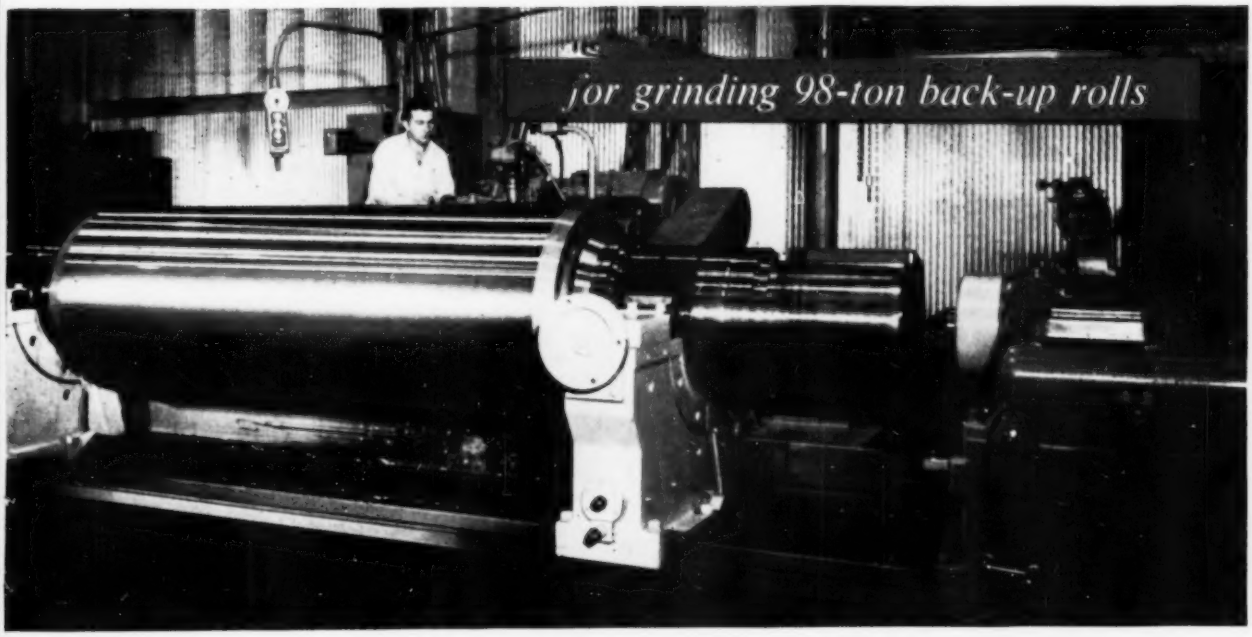
CINCINNATI FILMATIC

range of fine Roll Grinders . . .



Big rolls, dwarfing the operator, are ground on a CINCINNATI FILMATIC 60" x 312" Traveling Wheelhead Roll Grinder. *(Photo courtesy Kaiser Aluminum & Chemical Corporation)*

First impressions are lasting. And for anything passing between the rolls of a rolling mill, so are *last* impressions. That's why the finest sheet mill products come off rolls ground on CINCINNATI FILMATIC Roll Grinders. These machines are built in dozens of sizes and lengths, accommodating every type of roll imaginable. There are three general types:

1 For the *smaller* rolls, traveling table type with double sine bar cambering equipment

2 For *medium-sized* rolls, traveling table type with tilting wheelhead cambering equipment

3 For *large* rolls up to 100 tons, traveling wheelhead type with tilting wheelhead cambering equipment

All CINCINNATI FILMATIC Roll Grinding Machines have the power to remove metal rapidly, and ample rigidity to assure the finest finish. They incorporate many features of dependability . . . all are equipped with FILMATIC grinding wheel spindle bearings, the only self-adjusting, no-maintenance spindle mounting. Medium and large sizes are equipped with automatic wheel speed regulation. A unique equalizing roll driver assures accurate true-center rotation of the roll.

Considering all the advantages, Cincinnati is your first choice for the roll shop. Our Roll Grinding Specialists will be glad to visit your shop and give you firsthand information. Meanwhile you may want one of the catalogs tabulated in the spec table.

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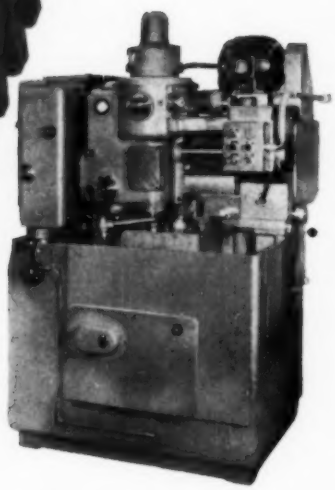
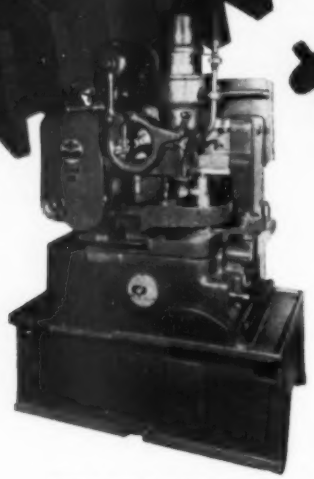


FELLOWS NO. 4GS

Among the products for which gears are cut on the 4GS are automatic transmissions, gasoline motors, hoist and well drilling equipment, computers and aircraft reduction gear units.



FELLOWS 7A-TYPE

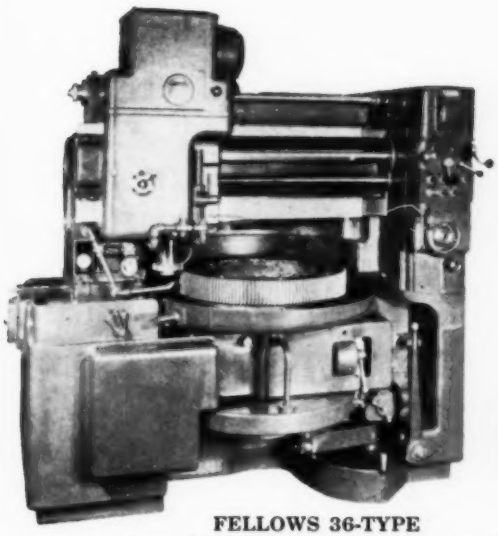
Gears cut on the 7A are used in textile machinery, servo-mechanisms, washing machines, cash registers, lawn mowers, machine tools and motorcycle engines.

FELLOWS 3-INCH FINE-PITCH

Used to cut gears for computers, bomb director and gun fire control systems, aircraft and flight control instruments, cameras and electro-mechanical mechanisms.

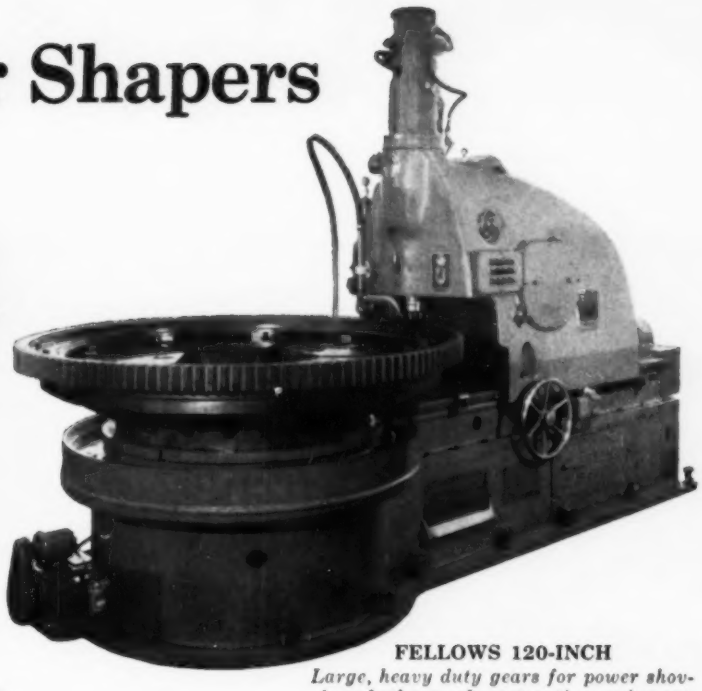
THE PRECISION LINE

Fellows Gear Shapers



FELLOWS 36-TYPE

Gears for construction equipment, textile machines, mining machinery, industrial truck transmissions, tractors, cranes and hoists are cut on this machine.



FELLOWS 120-INCH

Large, heavy duty gears for power shovels and other road construction equipment, heavy cranes, gun segments, tank turrets and winches are cut on the 120-Inch.

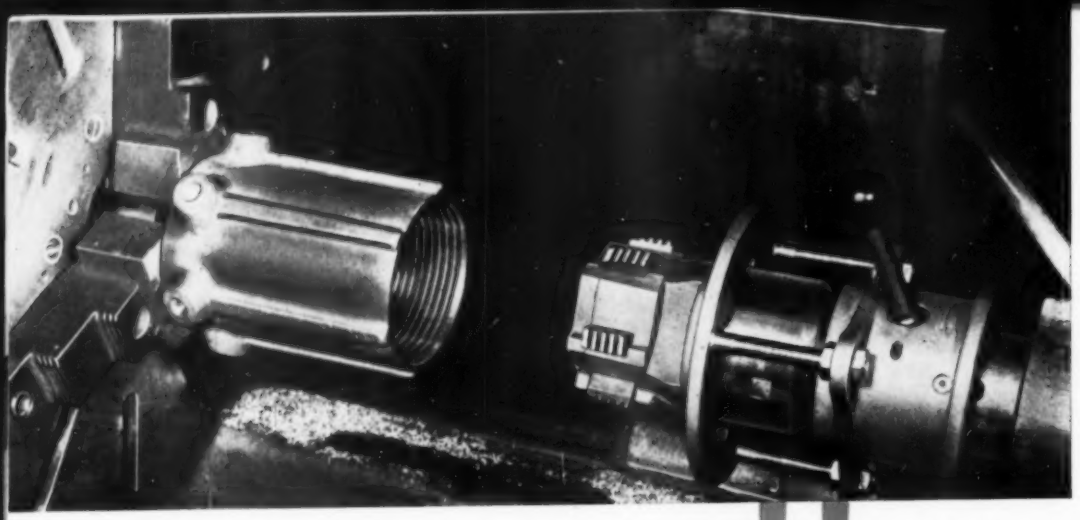
Modernizing cuts costs. In many plants the speed and versatility of new Fellows Gear Shapers has lowered gear production costs by more than a third and repaid the investment in just a few years.

Gear Shapers are ideal for many non-involute shapes too, such as internal and external splines, cams, clutches and nearly every other conceivable shape. Modifications to the Gear Shaper permit rapid, economical production of oval or elliptical gears. Fellows machines are available for either full- or semi-automatic operation for high speed, long-run production with a minimum of operator attention.

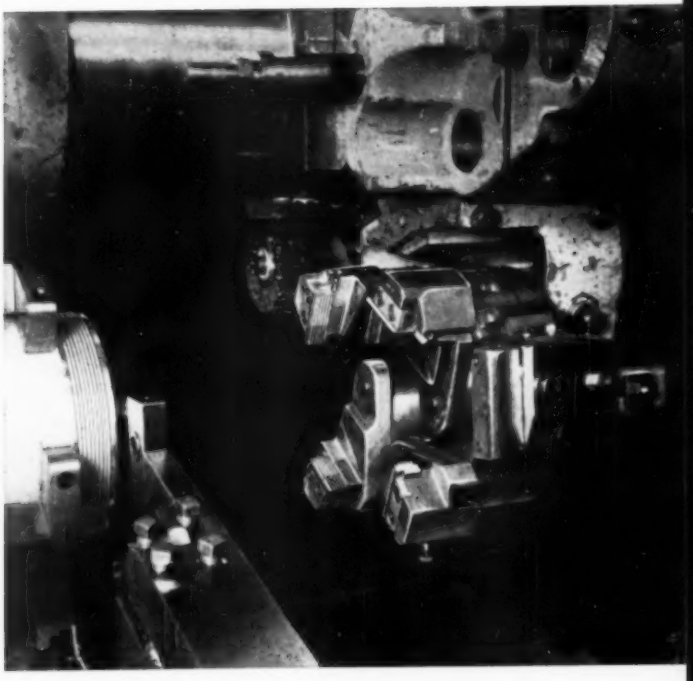
Your Fellows representative can show you where and how new machines from Fellows' Precision Line can lower your costs for small lots as well as for long production runs. Ask him for the facts.

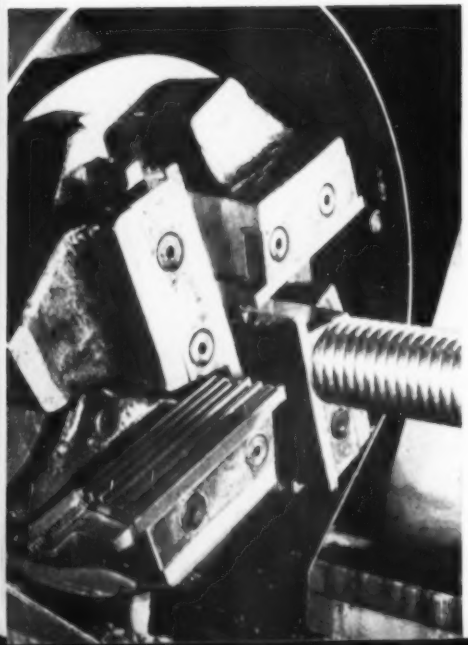
THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows Gear Production Equipment



the world's largest selection of **thread**





CIRCLE 176 READER SERVICE CARD

THREADING EFFICIENCY ...

requires the selection of the proper Thread Cutting Tool for the job to be done, and is the essence of LANDIS design. To ensure that you may use the most efficient threading tool, LANDIS manufactures the world's largest selection of Thread Cutting Tools ... both internal and external.

cutting tools

DIE HEADS ... in a range of ⅛"—9¼" for threading machines, turret lathes, screw machines, reversing spindle machines, bar automatics. *Heat-Treated* types for economy, wide range coverage, quick set-up changes and oversize capacity. *Hardened and Ground* types for work on which extreme accuracy and maximum production are of prime importance. *Solid Adjustable* types for high production threading on reversing spindle machines.

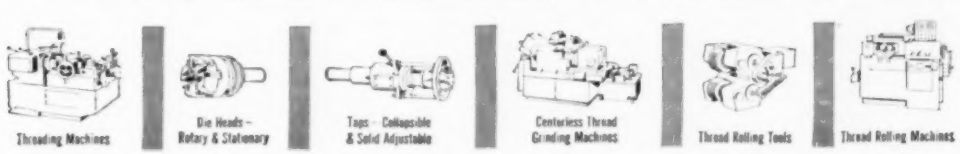
TAPS ... in a range of 1¼"—24". *Collapsible Taps* for producing parallel threads, *Receding Chaser Collapsible Taps* for tapered threads. Both have wide diametrical range through use of detachable heads. *Non-Collapsing Solid Adjustable* types for high production tapping on reversible spindle machines. Special Taps are available.

CHASERS ... all Landis Die Heads use Landis Tangential Chasers featuring: interchangeability, natural cutting clearance, permanent throat, useable for most of their length, right- and left-hand threads with the same chasers, and changeable rake and lead angles. Landis Tap Chasers, manufactured with the same consistency of quality and experience as the Tangential Chaser, are "tailor-made" to suit the application to produce a high degree of thread finish and the maximum number of pieces between grinds.

The constant research for better threading methods which has brought to LANDIS leadership in its field today plays an even more important part in our activities. We offer all manufacturers our over 50 years experience in all phases of Threading. If you need help involving threads, whether design or production, or if you feel that your present threading methods should be improved, send us your specifications, or our representative will call at your convenience on request.

LANDIS *Machine* COMPANY WAYNESBORO PENNSYLVANIA

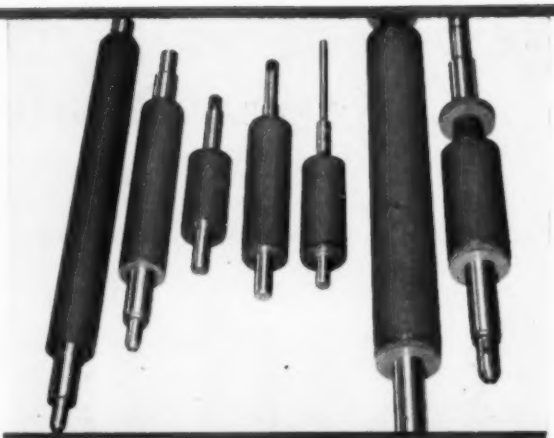
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

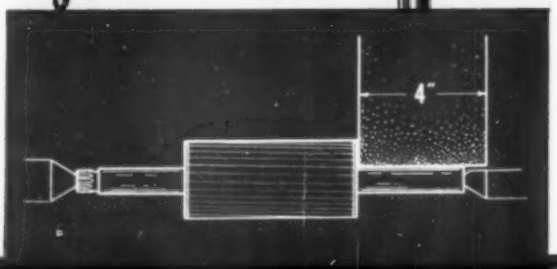

Threading Machines
Die Heads – Rotary & Stationary
Taps – Collapsible & Solid Adjustable
Centerless Thread Grinding Machines
Thread Rolling Tools
Thread Rolling Machines

653C

Infeed grinding with wide wheel raises

Various lengths and diameters of rotor shafts ground in small lots on new Landis grinder





production data

Operation:	Infeed grinding journal diameters of assembled rotors
Machine:	Landis 6" x 30" Type CH Plain Grinder with 4" wide wheel
Production:	25 to 46 parts per hour depending on size
Material:	304 Free Machining Stainless Steel
Stock removal:	.012"-.015"
Tolerances:	Bearings—.0002" with 12 RMS finish Other diameters—.0005" with 12-15 RMS finish

The accuracy of this Landis Plain Grinder minimizes rejects of costly rotor shafts. Lowers unit cost and maintains consistent high quality.

production over former traverse grinding

Coolant flow is stopped to show how footstock half center is used to grind short diameters with the 4''wide wheel.

Automatic wheel feed permits operator to dog the next workpiece while one is being ground.

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

EIMCO knows... with GUTS it

14 CIRCLE 180 READER SERVICE CARD

to build Mining Machines takes Tools with GUTS

They load more rock, move more ore, climb steeper grades . . . that's the reputation of these big bruisers built by the Eimco Corporation.

So in manufacturing, Eimco uses tools of equal toughness . . . Morse tools that cut smoother, faster and last far longer . . . tools that cut your cutting costs right to the bone, *and keep them there.*

So call a halt to uncontrolled cutting tool costs . . . call in your Morse-Franchised Distributor and let him go to work for you as your "Certified Cut-Accountant." Call him *now!*

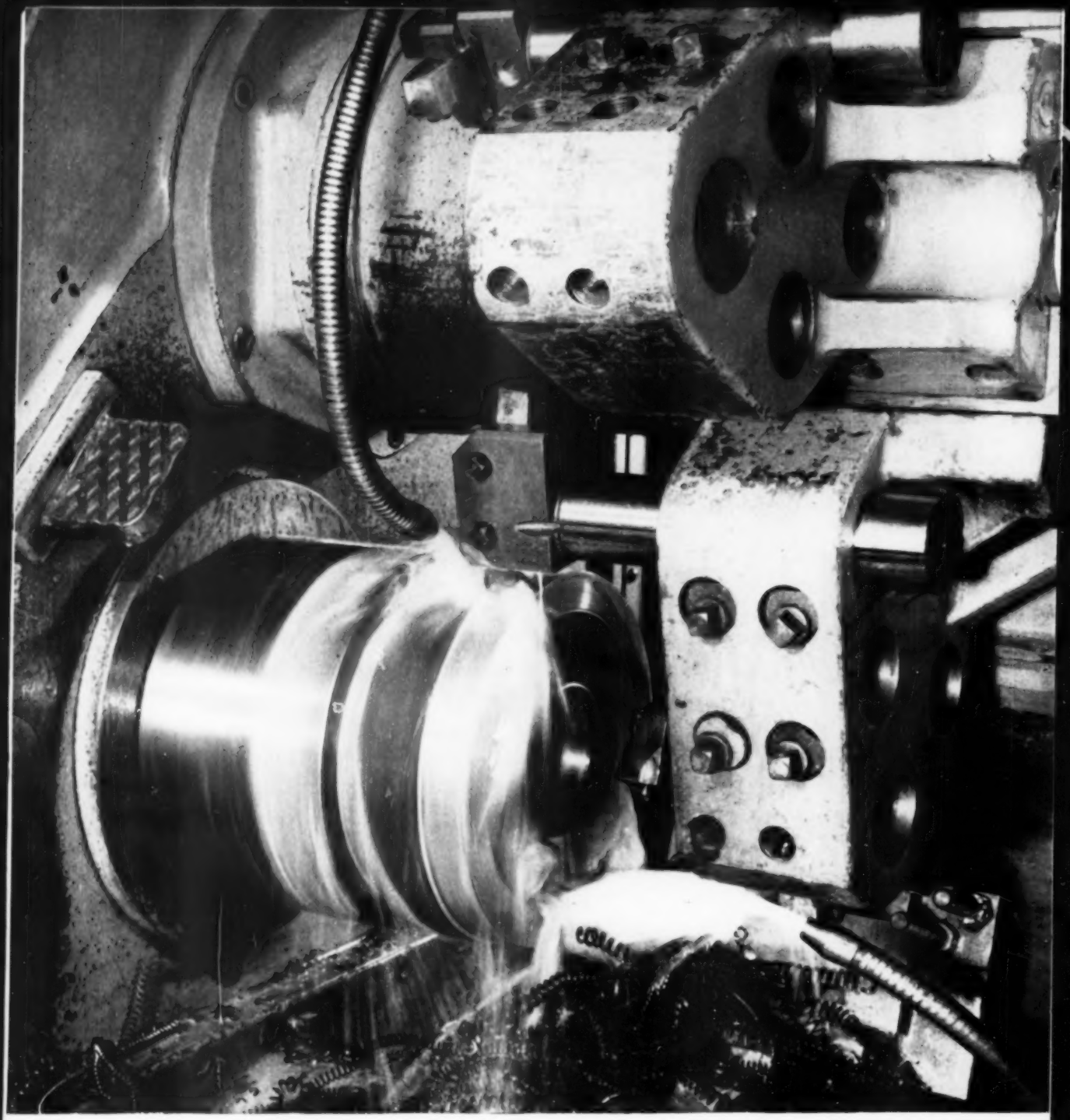
MORSE

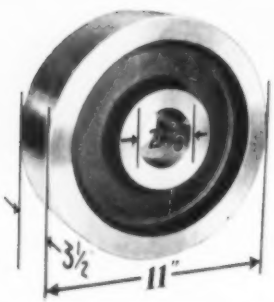
means "THE MOST" in Cutting Tools

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

A Division of VAN NORMAN INDUSTRIES, INC.

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO





SIX OPERATIONS WERE REDUCED TO THREE when this chrome molybdenum spur gear was blanked out on the Warner & Swasey 3AC's. Premium-grade carbide cutters are used throughout, many with throw-away tips to minimize downtime for cutter changing.

Fairfield's old method on this part required drilling, round broaching, spline broaching and three turning operations. Now all operations except spline broaching are combined into two chuckings – one on each of two 3AC machines – handled simultaneously by one operator. The result – blanking costs dropped 42%. After spline broaching the blanks are ready for machining of gear teeth. Lot sizes average about 200 pieces with frequent runs of only 25 pieces.

At Fairfield Manufacturing Company

Lafayette, Indiana

GEAR BLANKING COSTS CUT IN HALF –even on Job Lots– with WARNER & SWASEY SINGLE SPINDLE CHUCKING AUTOMATICS

Fairfield, one of America's largest independent producers of precision cut, automotive-type gears, had a production "bottleneck" in their gear-blanking department.

To increase production and still keep costs in line, particularly on the smaller lots, greater machine tool versatility was needed. Method analyses revealed that any new production equipment under consideration should be more rigid for greater accuracy—capable of using the latest in carbides for faster metal removal—and permit combining of extra operations into single chuckings through more efficient tool setups and thus eliminate costly special tooling.

New Warner & Swasey ACs fulfilled these conditions. Ten machines – six 2 ACs and four 3 ACs—were installed over a period of four years. From the start of the first pair of machines, production increased immediately, costs dropped substantially!

Fairfield's new Warner & Swasey Single Spindle Automatics provided:

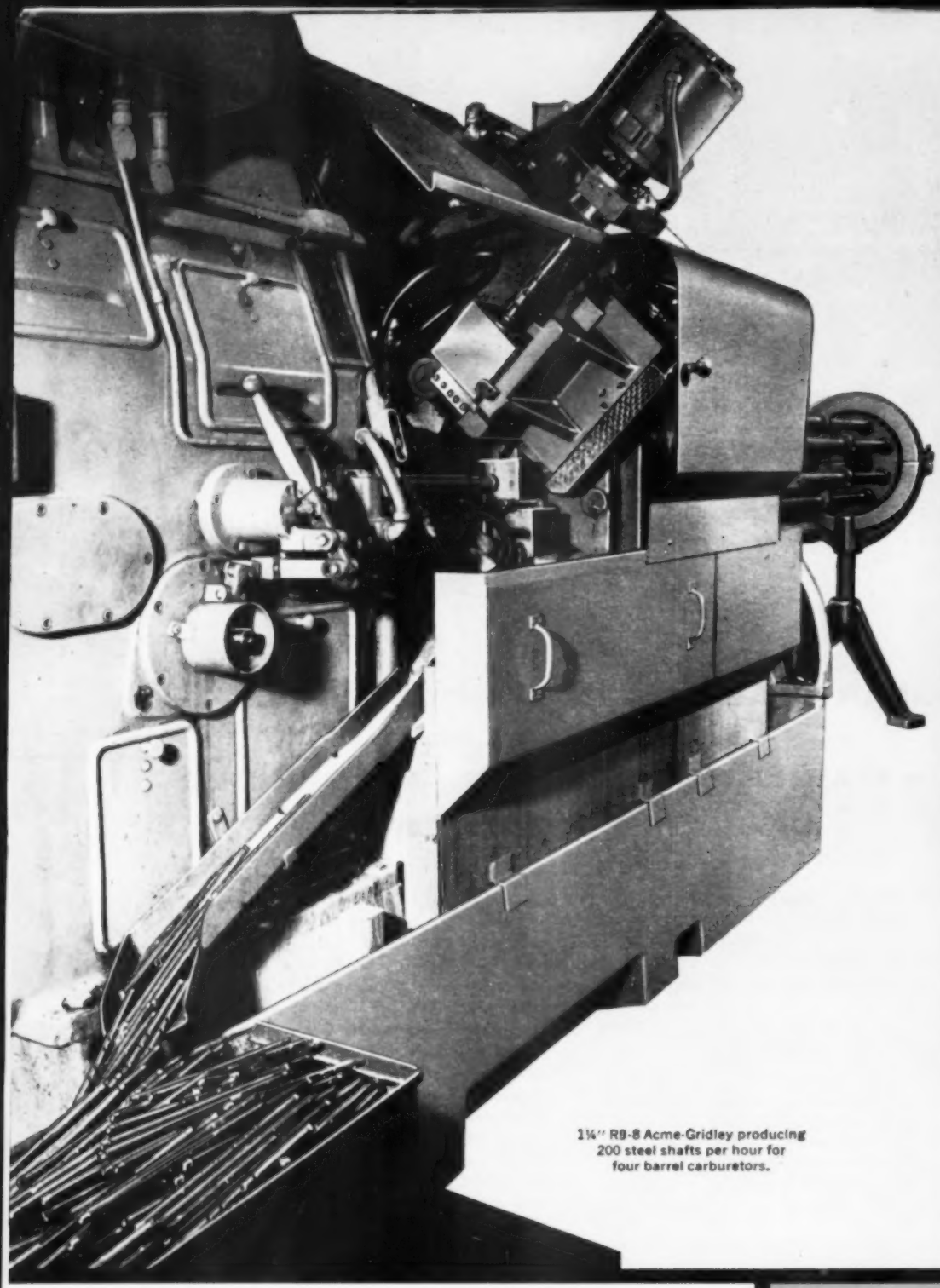
- **Extreme boring and turning accuracy that completely eliminated "green" grinding operations.**
- **Power, speed and rigidity which allowed utilization of today's most advanced cutting tool materials to their fullest capabilities.**
- **Unexcelled reliability which has all but eliminated downtime for other-than-normal preventive maintenance – and this based on around-the-clock operation!**
- **Ample tool stations (five turret and two cross slide positions) coupled with standard tooling ease and flexibility which permitted consolidation of separate operations in a single setup.**

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

CIRCLE 183 READER SERVICE CARD

CIRCLE 184 READER SERVICE CARD ►



1¼" R9-8 Acme-Gridley producing
200 steel shafts per hour for
four barrel carburetors.

NATIONAL ACME'S "ZONE OF RESPONSIBILITY"

INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Carter Carburetor . . . an "every day" job for Acme-Gridleys.

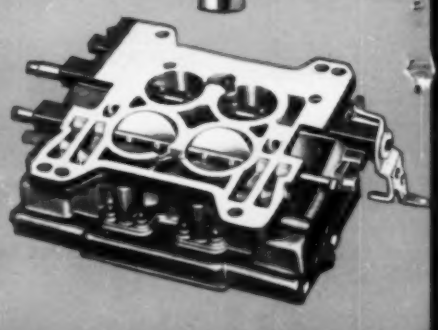
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.



Versatile Acme-Gridley produces

EIGHT DIFFERENT PARTS

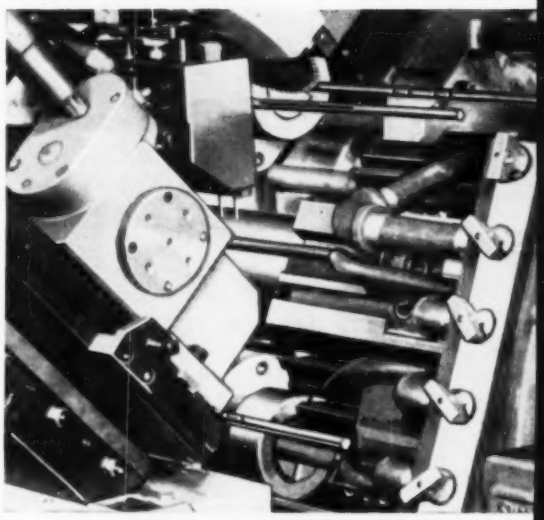
With Only Minor Changes in Tooling Setup

For Carter Carburetor *division of ACF Industries, Inc.*

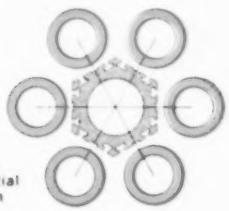
Here's machine tool versatility at its best . . . versatility that provides documented cost savings for Carter Carburetor year in and year out. Machine investment and cost-per-piece are greatly reduced. Illustrated is but one example.

The spindles of a standard 1¼" RB-8 spindle Acme-Gridley bar automatic were locked against rotation with a simple spindle locking device. Each spindle functioned as a work holder when the machine indexed from position to position. The inherent accuracy of Acme-Gridleys assured precise alignment of the work with the standard and special attachments . . . whether it's the first or last piece in the run. When spindle rotation is desired, the locking device is simply removed and replaced by the spindle drive gear.

Check the industry's most modern approach to tangible cost reduction. Call, write or wire today!



Close up of tooling zone showing milling of slot in 4th position.



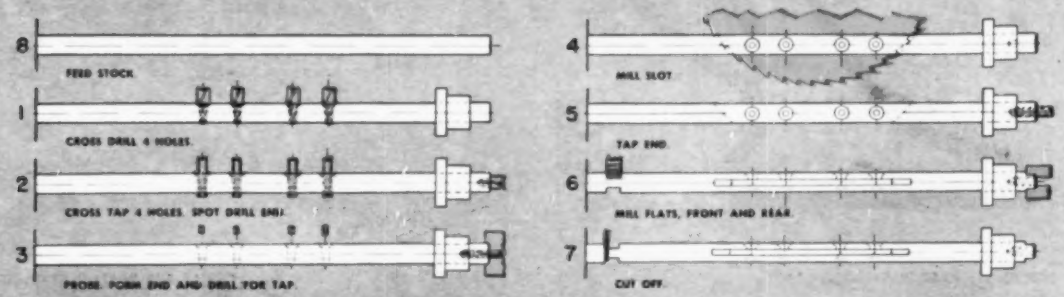
Pioneer in Circumferential Automation

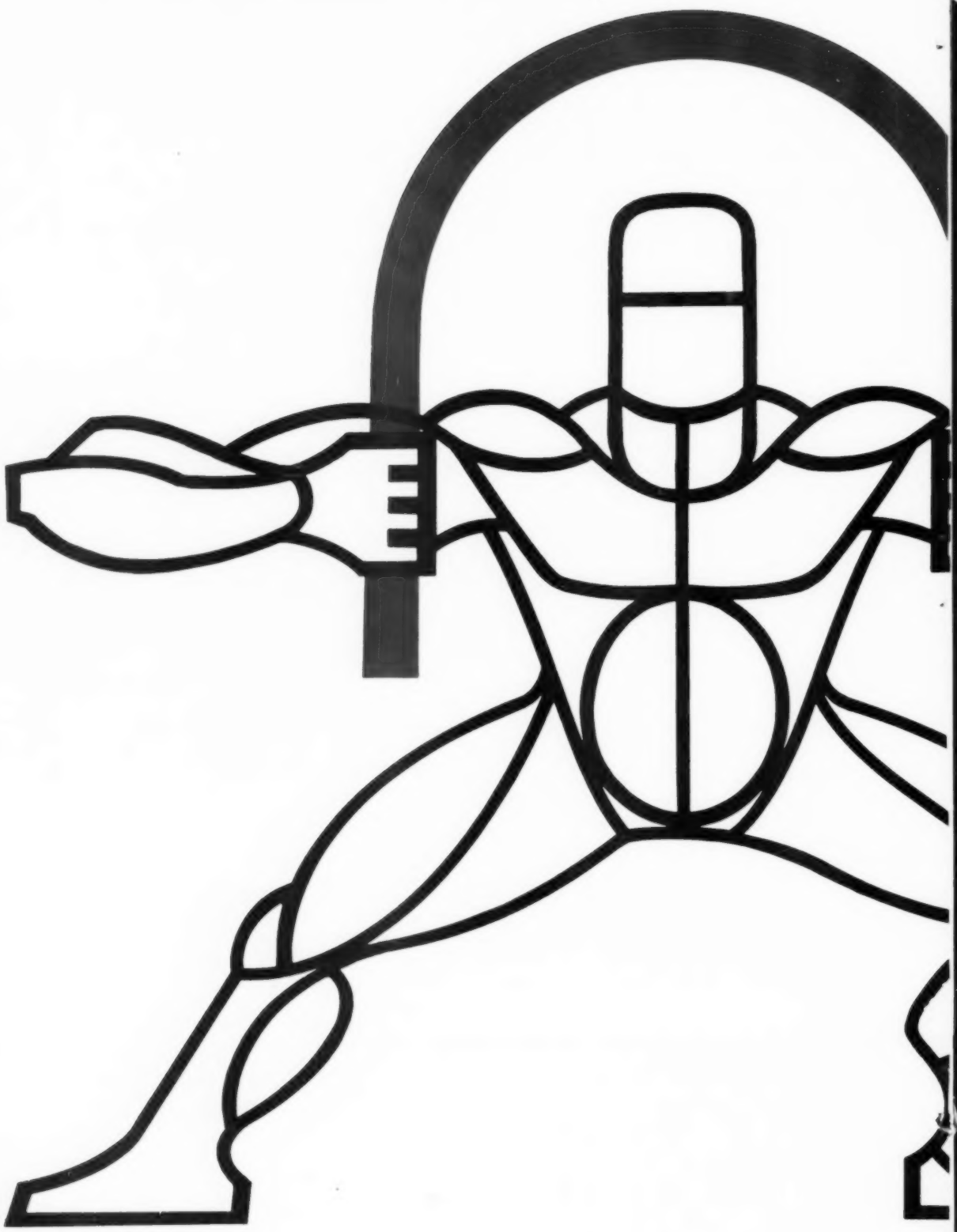
National Acme

THE NATIONAL ACME COMPANY
171 E. 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

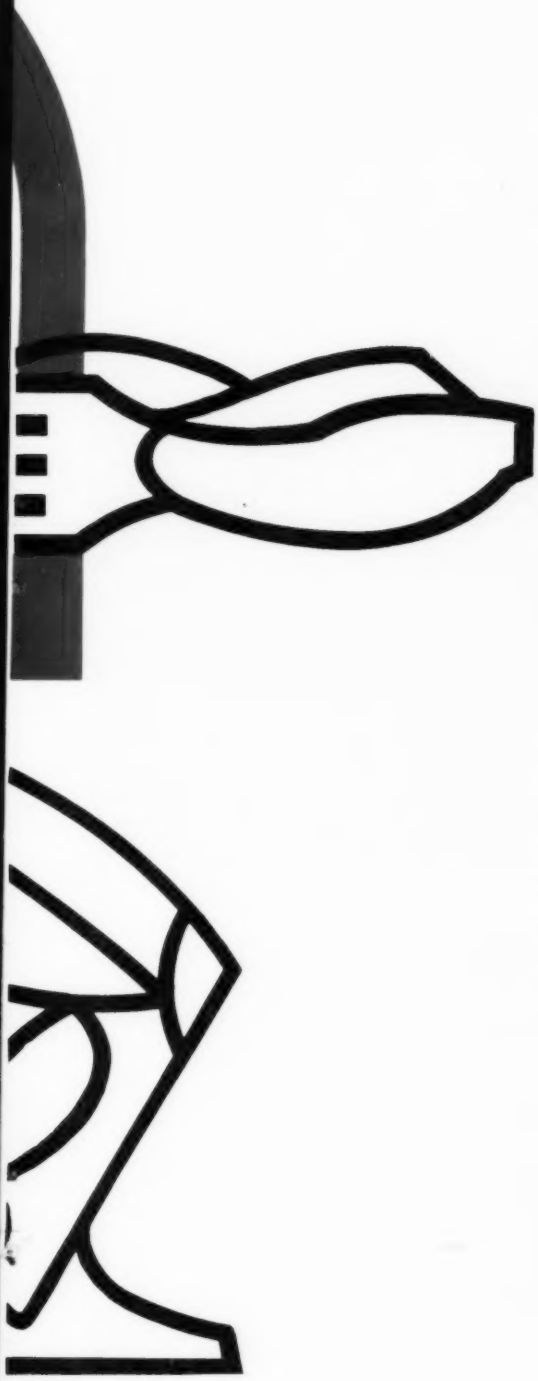
16 Operations





◀ CIRCLE 185 READER SERVICE CARD

CIRCLE 186 READER SERVICE CARD



NOW... SUPERIOR FORMABILITY IS AVAILABLE IN AN EXTRA-STRENGTH STEEL

N-A-XTRA

BEST LOW-ALLOY EXTRA-STRENGTH STEEL YOU CAN BUY

N-A-XTRA HIGH-STRENGTH is a heat-treated steel now available in minimum yield strengths of 80,000-110,000 psi.

Unlike most steels of this strength and toughness, N-A-XTRA can be cold formed into difficult shapes, gas-cut, sheared, machined, and otherwise handled by conventional fabricating methods. It has superb weldability—by any process. And its great strength gives designers and engineers a unique opportunity to eliminate useless dead weight from finished products.

For complete information on N-A-XTRA—the best low-alloy extra high-strength steel you can buy—write Great Lakes Steel Corporation, Detroit 29, Michigan, Dept. X-9.

N-A-XTRA

GREAT LAKES STEEL

A DIVISION OF NATIONAL STEEL CORPORATION

New Sundstrand Multiple Spindle Drilling and Boring Machine Offers Precision at Low Cost

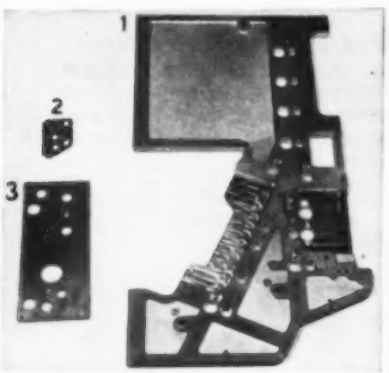
Sundstrand's new precision drilling, boring reaming and tapping machines, permit higher accuracies and lower costs in producing large numbers of holes on relatively complex parts. Unique design of the work heads eliminates all gearing, permitting close center distances, reducing cost of interchangeable work heads, and speeding change-overs.

Two models are available with either an 18 x 36-inch head or a 9 x 14-inch head. Machines are designed primarily for work with nonferrous metal parts.

Complete work heads can be changed in 15 to 20 minutes and additional flexibility for similar parts is offered by equipping heads with spindles that can be fitted quickly with a tool as required.

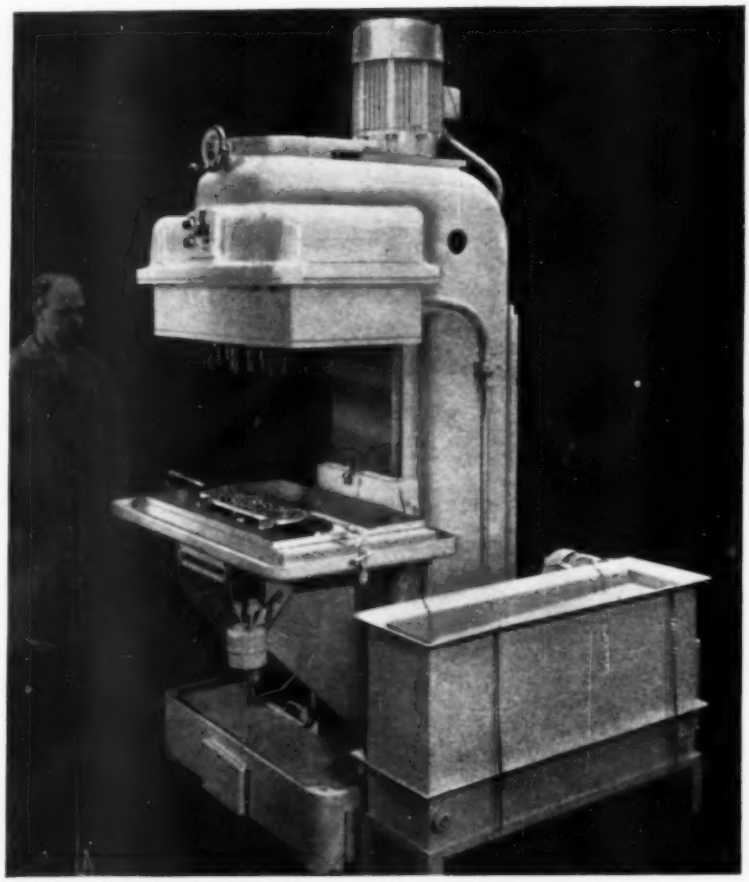
Unique design enables relatively low cost spindles to be used while maintaining the highest standards of accuracy. Furthermore, in the event of a change over in work being handled, approximately 75% of an obsolete head can be salvaged and applied to other jobs.

Highly skilled operators are not required to hold tolerances to .0002 inch for spatial relationship, shoulder depth and hole size — depending on size of part, shrinkage, expansion, material composition, tool maintenance, etc. Inspection requirements are greatly reduced because spatial accuracy is built into the head, fixtures, and machine itself.



Typical parts show wide range of work handled on new multiple spindle machine. Additional data is given in table on facing page.

Following initial inspection of tooling and a check of first parts produced, subsequent parts need only be checked for hole size and shoulder depth. Where spatial relationships are extremely critical occasional spot check is generally all that is required.



New Sundstrand multiple-spindle machine offers precision and simple change over, does not require highly skilled operator.

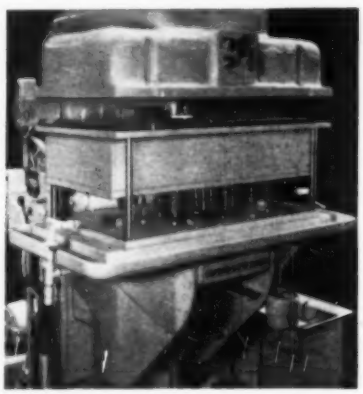


Table is lowered to take new work head in change over then is elevated until coupling on drive spindle mates with machine spindle. Dowels insure accurate alignment, four bolts hold head in place.

Even change-overs take no special operator skills since the head mates with the machine spindle, is located by dowels and is held in place by four bolts. The work-holding fixture is positioned quickly and simply in relation to the work head.

Surface speed at the largest hole being machined with a particular head determines all spindle speeds.

"Engineered Production" Service

SUNDSTRAND

TYPICAL PERFORMANCE DATA

JOB NO. 1 ALUMINUM SIDE PLATE — 32¾" x 17" x ¾". Seven heads are used to drill and chamfer 138 holes and to perform semifinish and finish boring, counterboring, and reaming operations on selected holes. Tolerances in most critical holes are +.0005, −.000 for size and ±.001 for location. Total machine time 4 minutes.

JOB NO. 2 ALUMINUM BEARING PLATE — 2.4" x 3.9". Stamped part has over 30 small holes and four large holes precision bored to +.0002, −.000 for size and ±.0001 for location. Total machine time 7 minutes.

JOB NO. 3 ALUMINUM SIDE PLATE — 12½" x 5" x ¾". Large holes previously rough drilled. All small holes are drilled, critical holes are semifinish bored, 2 holes are counterbored, and in final operation all critical holes are finish bored to +.0005, −.000 for size and ±.001 for location.

This does not impose any limitation on production as no other method will produce an equal number of holes at as low a unit cost and with the same high degree of accuracy.

Feed rates for drilling, rough and semi-finish boring in aluminum and magnesium are .005 to .008 inch per revolution. Finish boring in the same materials is at .0005 to .001 per revolution. Tapping heads can also be provided with the specific details of the application determined after a study of all the variables.

Multi-cycle 25 hp Lathe Announced

Sundstrand's new Model 14T-25 lathe handles three roughing and a finishing cut with a single template in a fully automatic cycle and insures exceptional accuracy of finished work because stylus and cutting tool are closely coupled to reduce deflection and related errors. Setup times are reduced and accuracy is increased by graduated scales provided for dog setting, template positioning, tailstock positioning, and cross facing slide location.

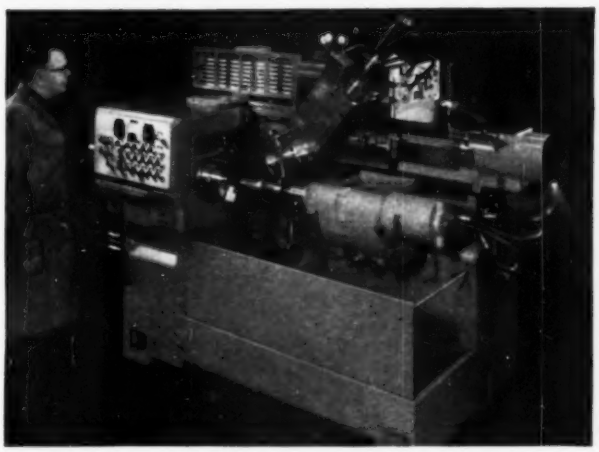
Dial indicators at the top of the tracing carriage permit depth of cut to be set accurately. At the completion of three roughing cuts, the tool turret indexes automatically to take a .020-inch finishing cut.

The Model 14T-25 is designed with the rigidity and spindle speeds required to use carbides for the roughing cuts and ceramic tooling on the finishing cut. Either two or four speed transmission-type heads are considered standard with eight speed heads available on special order.

Work area is readily accessible to simplify loading by operator or addition of automatic workhandling equipment. Sundstrand Model 14T-25 lathes are available with 24, 32, or 40 inches length between centers and offer a maximum turning diameter of 4½ inches. Facing slides with separate feed unit permitting operation at any time during machine cycle are available as optional extras.

Rough forging and finish turned shaft produced on Model 14T-25 lathe. Two setups handle complete part.

Stem pinion forging is turned in two setups with production rate determining whether one or two lathes handle the job.



Newly designed Model 14T-25 Sundstrand tracer lathe provides three roughing and one finishing cycle automatically.

SUNDSTRAND MACHINE TOOL

DIVISION OF SUNDSTRAND CORPORATION

BELVIDERE, ILLINOIS

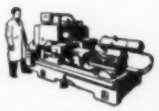
SUNDSTRAND

More facts about

SUNDSTRAND

"Engineered Production"

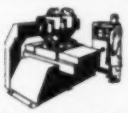
Literature listed under various machine types has more details. Write Sundstrand for your copy today.



Automatic and Tracer Lathes
Bulletin A-106

Engineered Milling Production
Bulletin B-106

Examples of Transfer Machines—Bulletin C-106

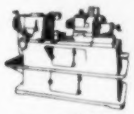


Multiple-spindle Drilling Machines—Bulletin D-106

Internal and Rotary Surface Grinders—Bulletin E-106

Broaching Tools
Bulletin F-106

Practical Broaching Methods
Bulletin F-106



Thread Milling,
Bulletin G-106

Fine tools that encourage Good Work

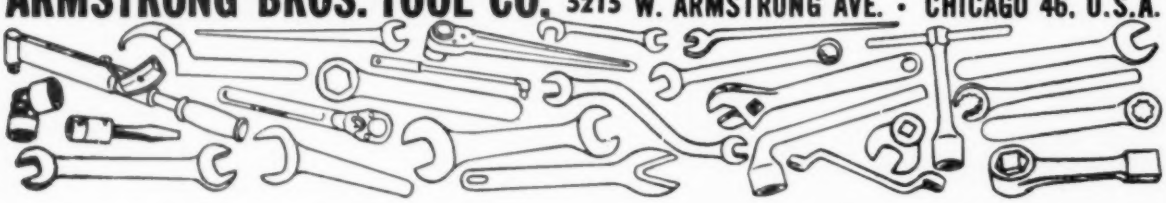
ARMSTRONG WRENCHES

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

INDUSTRIAL DISTRIBUTORS · SERVING INDUSTRY ECONOMICALLY · THE RIGHT HAND OF PRODUCTION

If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

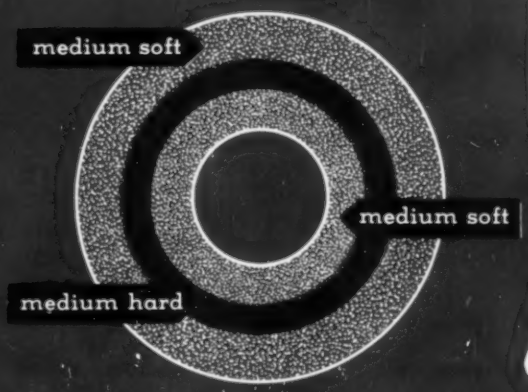
ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.



Disc with heat resistant BK bond increases production 70%

Grinds over 70,000 washing machine gear cases per disc

Three-grade disc with heat resistant BK bond retains flatness, needs fewer dressings



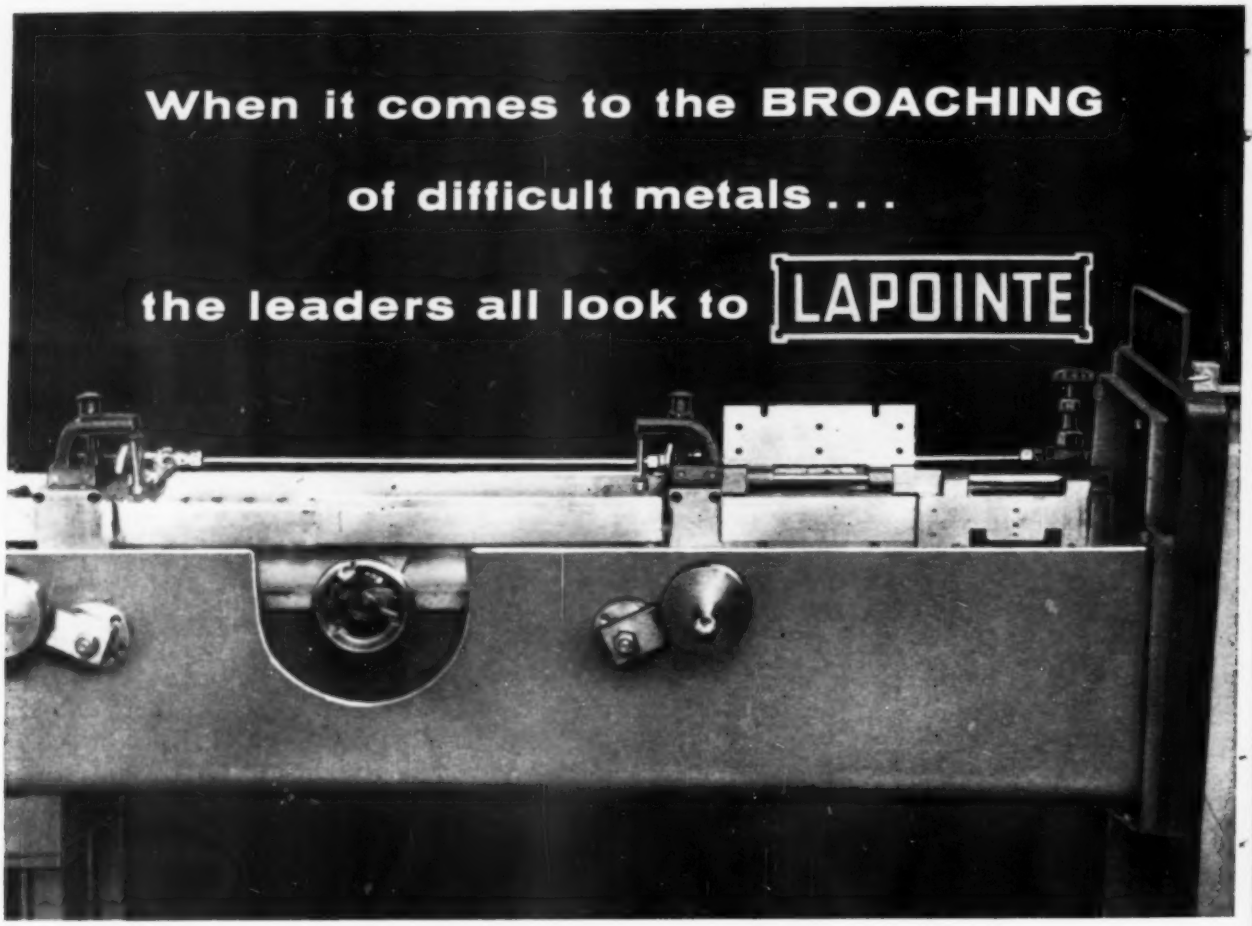
grinding costs cut 1/3 to 1/2

- longer disc life
- elimination of work burn and warping
- fewer dressings—higher output

GARDNER

abrasive discs

BELOIT, WISCONSIN

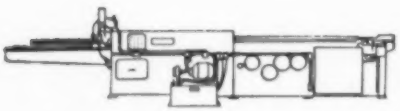


THE LAPOINTE MACHINE TOOL COMPANY

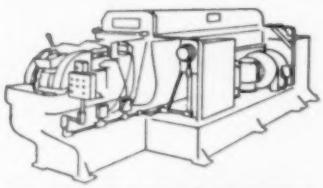
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

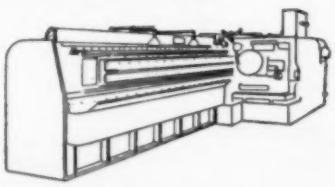
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



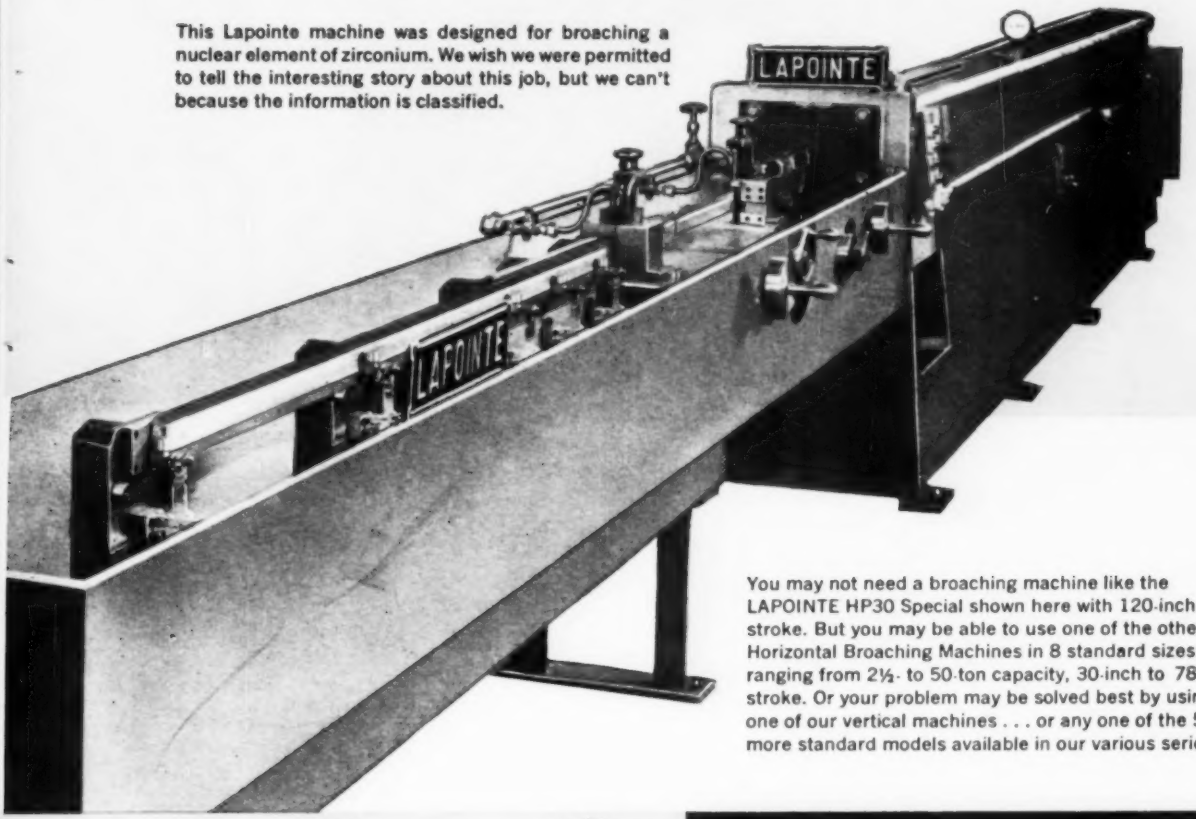
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

CIRCLE 192 READER SERVICE CARD

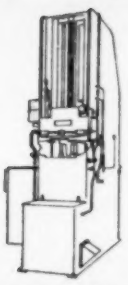
Zirconium, anyone? . . . for broaching, that is! All of the new atomic-age metals — the tough ones like zirconium, titanium, uranium, 347 stainless — are being broached with complete success on Lapointe machines. And why not, since Lapointe has had the most experience with broaching all such alloys? With us, zirconium broaching dates back to 1950, but our general broaching background began in 1902. We were *first in the field* with modern broaching, first with the answers to problems that have constantly been arising with the continuing improvement in the composition of metals.

If you are machining metal by milling, shaping, planing or some other conventional method, it may well be that *you can broach it better, by Lapointe.* One of our qualified Field Engineers will be glad to discuss with you the possibilities of converting to Lapointe-Broaching, to improve your production rate, your cost factor, *and your quality.*

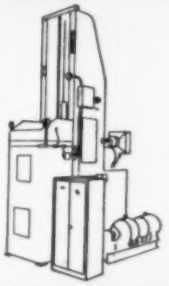
This Lapointe machine was designed for broaching a nuclear element of zirconium. We wish we were permitted to tell the interesting story about this job, but we can't because the information is classified.



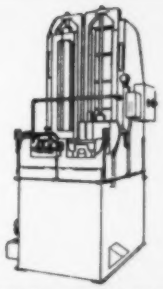
You may not need a broaching machine like the LAPOINTE HP30 Special shown here with 120-inch stroke. But you may be able to use one of the other HP Horizontal Broaching Machines in 8 standard sizes ranging from 2½- to 50-ton capacity, 30-inch to 78-inch stroke. Or your problem may be solved best by using one of our vertical machines . . . or any one of the 50 or more standard models available in our various series.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

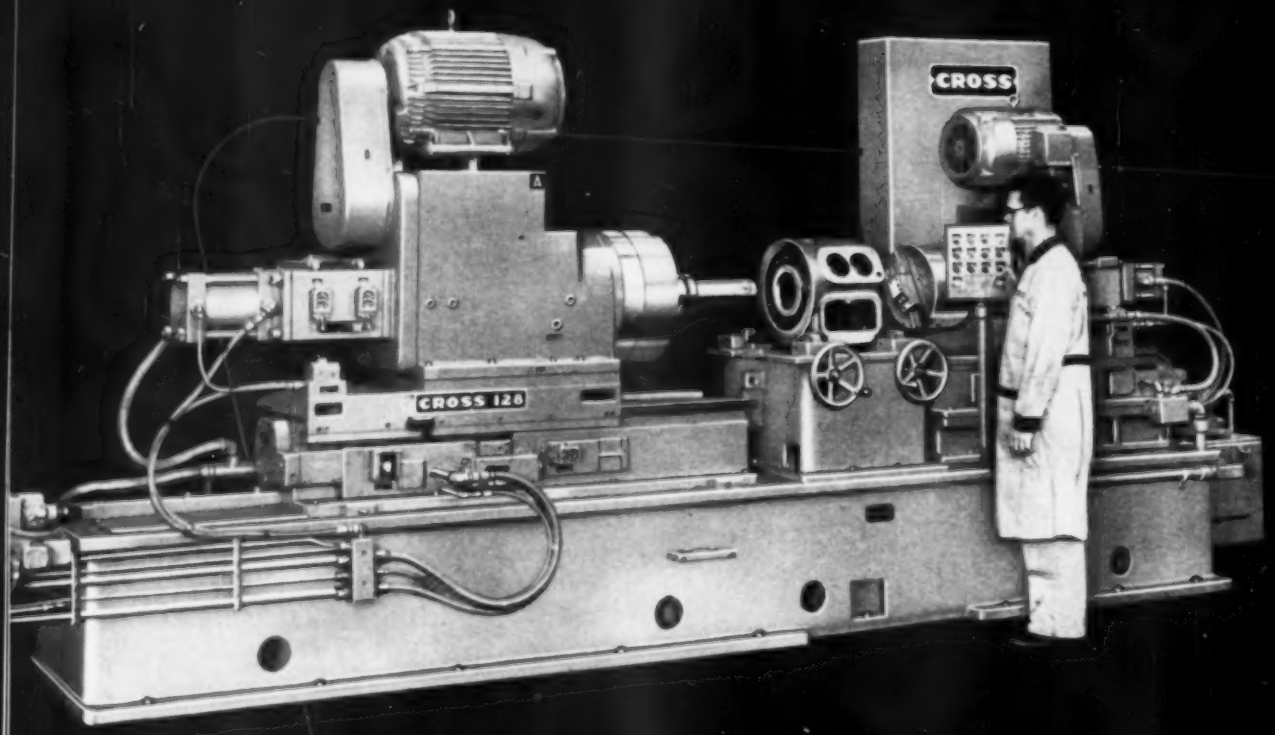
known to be the best in

BROACHING

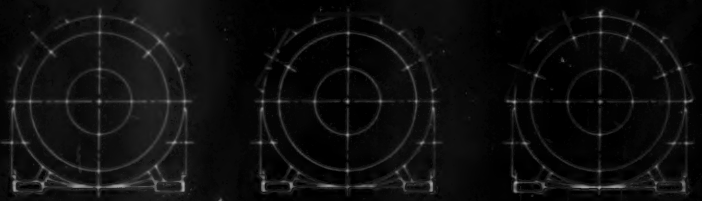
CIRCLE 193 READER SERVICE CARD

CIRCLE 194 READER SERVICE CARD ►

Automation for Short Run, Low Volume Production



PRODUCT MIX

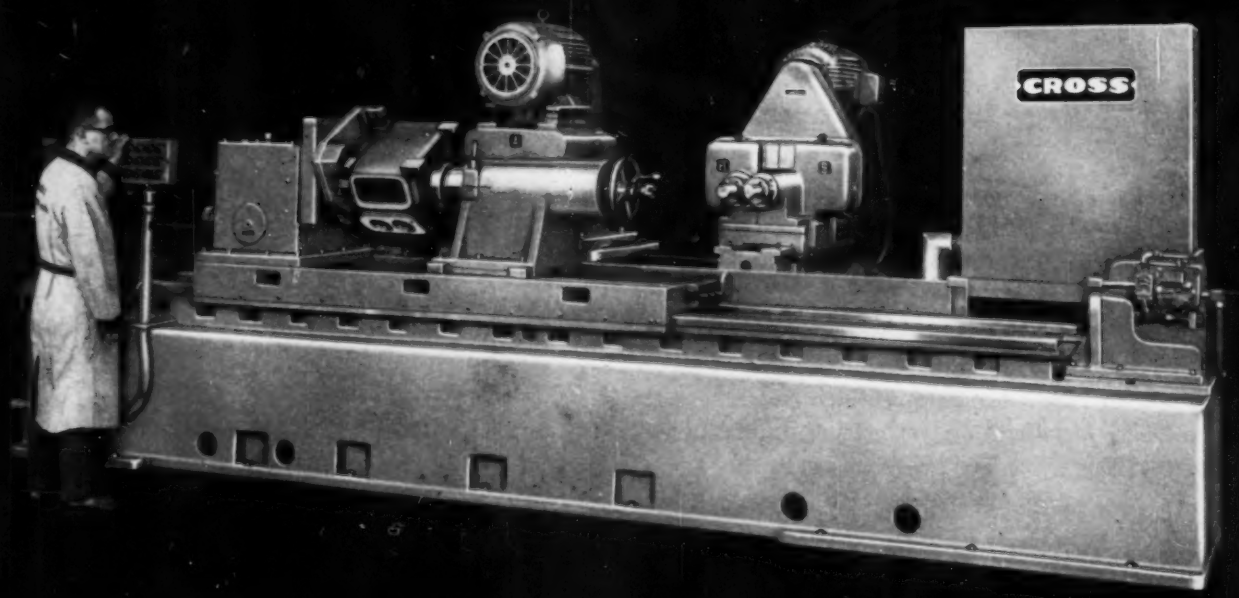


Two-bank compressor for several 4 cylinder models.

Three-bank compressor for several 6 cylinder models.

Four-bank compressor for 8 and 12 cylinder models.

More Specials by Cross



Featuring a high degree of precision, processing versatility and machine flexibility, these two new Cross machines process a complete product mix of 4, 6, 8 and 12-cylinder hermetic compressor housings in lots of 50 each. The two-way boring and facing machine rough and precision finishes crankshaft bores, thrust faces and the motor mounting face. The two-station shuttle-type machine rough and finishes all bank faces and cylinder bores.

Both machines provide completely automatic operations including part indexing and shuttle; incorporate automatic lubrication including new methods of lubricating cross facing heads automatically; and both provide optimum flexibility for handling future part design changes including major dimensional variations in the number, diameter and location of cylinder bores.

Both the two-way and shuttle machine combine rugged dependability for heavy stock removal in roughing with a high degree of accuracy for precision finishing. Critical tolerances are held closely; bank and thrust faces relative to cylinder bores are held square within. 001"; main bore and cylinder bore diameters concentric within .001"; motor mounting face and crank bore thrust faces held parallel within .001".

The two-way and shuttle machines are smaller and far less costly than a group of standard machines that would be required to perform identical operations without automated features and advantages.

Both machines incorporate standard Cross "Building Blocks" including wing bases and feed units. All standard and special parts are completely interchangeable for easy servicing.

For details on these—and other automated Cross machines for profitable, low volume production, write, wire or phone:

Established 1898

THE CROSS CO.

First in Automation

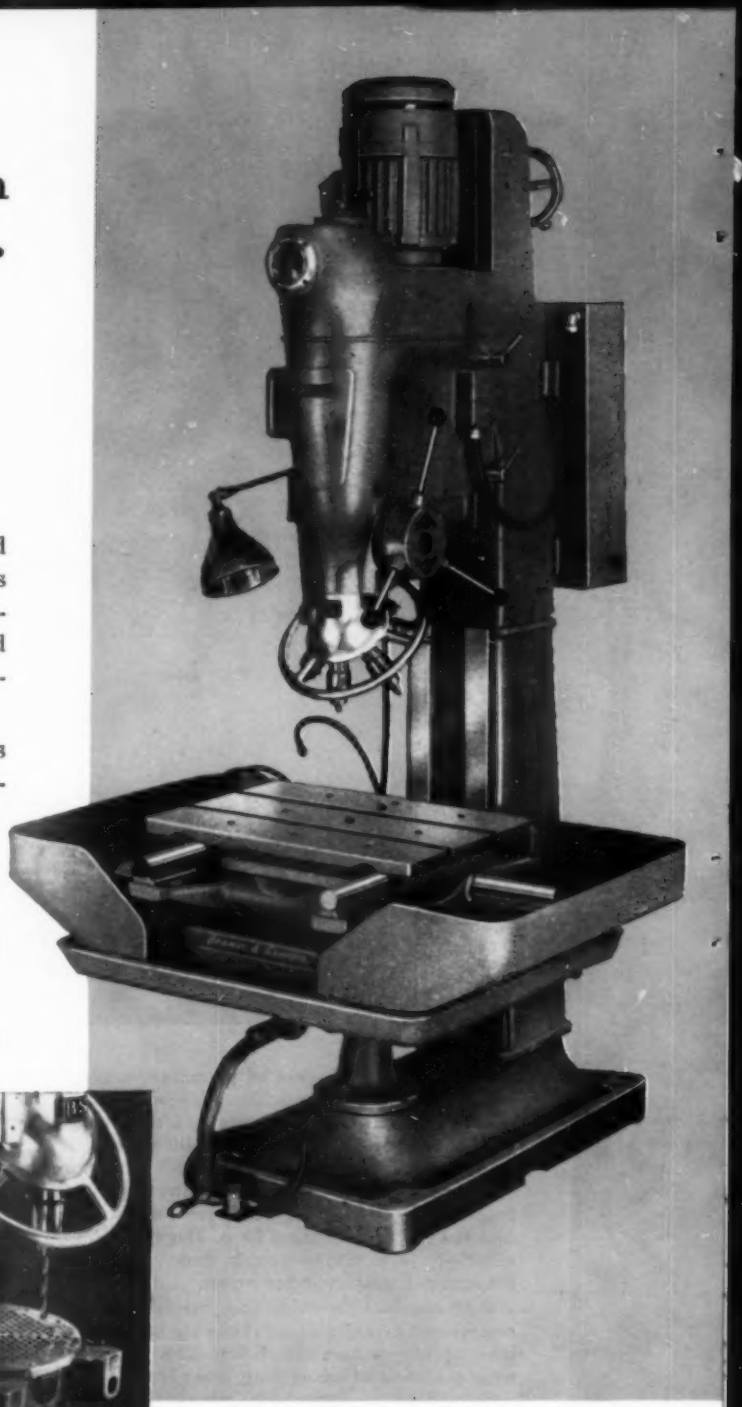
PARK GROVE STATION • DETROIT 5, MICHIGAN

Now... you can drill - tap - bore - ream 2 to 5 times faster

- at a single station
- without box jigs
- with one set-up
- any hole pattern

Multiple drilling operations at a single station, and fast, accurate hole location without expensive jigs are only two of the major advantages of the revolutionary Brown & Sharpe Turret Drilling method that is setting entirely new standards for production drilling economy.

Find out how it can help you beat mounting costs . . . save handling time, set-up time, capital investment, floor space, and maintenance.



The Brown & Sharpe TURRET DRILLING MACHINE pays for itself with record savings on jobs like this

Drilling and tapping tube sheets at the Whitlock Mfg. Co., West Hartford, Conn., makers of heat transfer equipment, is an example of the hundreds of installations where users report record savings in time and costs. On the B&S Model A Turret Drilling Machine, 220 tube holes are drilled, and 12 bolt holes drilled and tapped, in 22 minutes. The B&S Work-positioning Table permits easy, progressive movement and accurate location of the workpiece for each hole — saves the time formerly required for a complete layout of the hole pattern on each piece. Completely eliminates the need for guide bushings.

TWO SIZES

MODEL A (shown) 6 spindles • ½" drilling and tapping capacity in steel • table work surface 22" x 24".

MODEL B 6 spindles • 1" capacity in steel • table work surface 28" x 32" • may be equipped with any standard numerical (tape) control system for fully integrated automatic work-positioning and machining.

For complete information, write:

Brown & Sharpe TURRET DRILLING DIVISION, Inc.

20 Fitch St., East Norwalk, Connecticut

Brown & Sharpe PRECISION CENTER

◄ CIRCLE 195 READER SERVICE CARD

CIRCLE 196 READER SERVICE CARD

New concept in productivity...

Brown & Sharpe Model B Turret Drilling Machine...

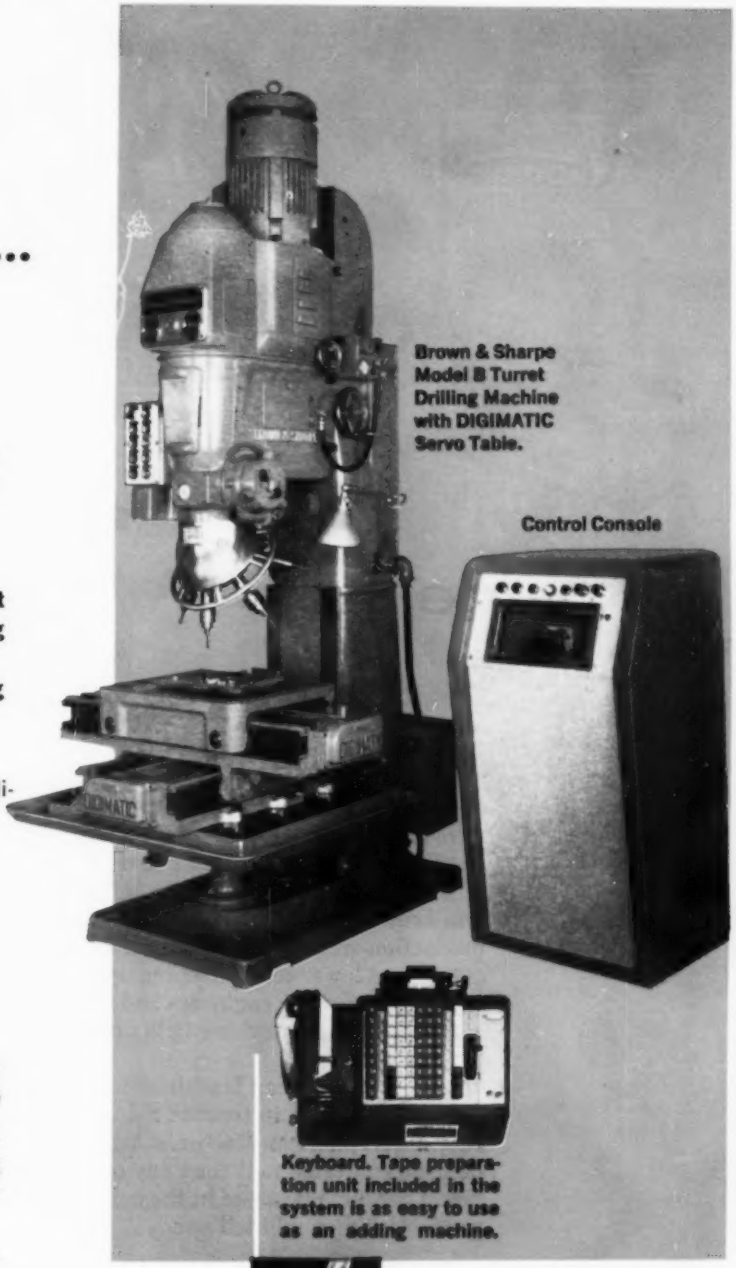
DIGIMATIC† Model 202 Point-Positioning System

. . . combine to give you the lowest-cost complete tape-controlled turret drilling system for:
drilling • tapping • boring • reaming

- New freedom in designing
- Engineering changes effective immediately (change tape, not tooling)
- Tighter machine scheduling
- Lead time and tooling costs cut drastically
- Expensive jigs and templates eliminated

ASK US TO ARRANGE A DEMONSTRATION WITH YOUR BLUEPRINT AND YOUR PART. Write for the free booklet, "DIGIMATIC Model 202 Point-Positioning System." Also: movies shown at your plant or shop on request.

†DIGIMATIC is our trademark.



Brown & Sharpe Model B Turret Drilling Machine with DIGIMATIC Servo Table.

Control Console

Keyboard. Tape preparation unit included in the system is as easy to use as an adding machine.

Tooling With Tape

STROMBERG-CARLSON
A DIVISION OF **GENERAL DYNAMICS**
1491 N. GOODMAN STREET • ROCHESTER 3, NEW YORK

"We've got 500 men in the shop"

"When we brought out two new product lines last year, I convinced management that we ought to automate machine operations so we wouldn't have to take on a lot of new help. The new set-up is really paying for itself. Got the idea from an article I read some time ago."

You hear that kind of observation again and again from Metalworking production men. In today's fast-moving economy, emphasis is on increased output and lower costs. Keeping up with what's new – and what's coming – is a must for the engineers and executives who guide production in the $120 billion Metalworking industry.

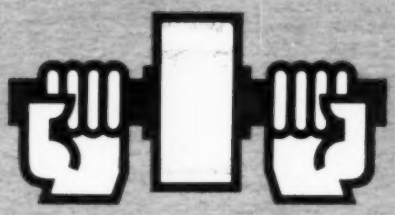
That's how American Machinist works for these men. Whether their jobs are behind a desk, in front of a drawing board or bossing the crew on the shop floor, American Machinist helps them do their jobs better. Thus, more of them subscribe to it than any other Metalworking publication. It's the "most useful" magazine in the field. That's why, in Metalworking plants, production men will tell you . . .

"I have to read American Machinist"

While Mr. McGowen is hypothetical, he's typical of Metalworking production executives. Your American Machinist representative will gladly provide real buying-action verbatims from actual men in Metalworking.

McGraw-Hill Magazine of Metalworking Production
330 West 42nd Street, New York 36, New York

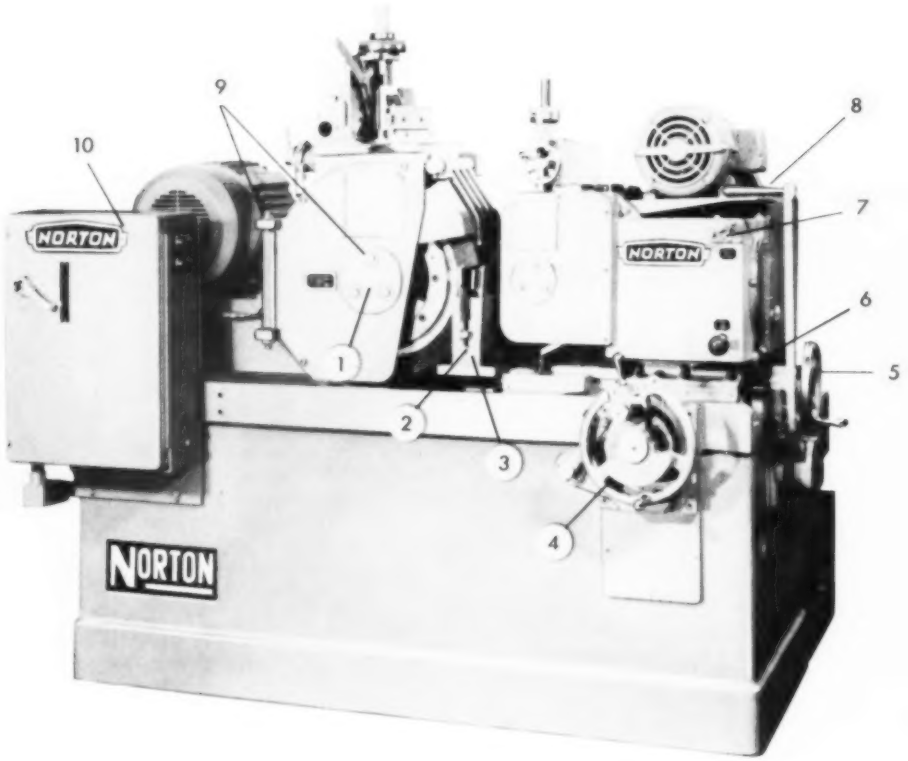
Newest Norton Grinder!



The No. 2 Straddle-Bearing Centerless ...latest development in its field

Ready for immediate delivery . . . bringing you the expertly engineered advantages described inside

Showing you how the
New Norton Straddle-Bearing
is built for speed . . . accuracy . . .



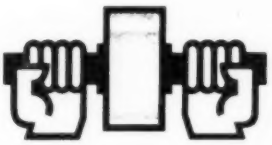
Ready for Immediate Delivery
The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semi-automatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 4 3/4" depending on type of work rest and bar grinding fixture.

Like all Norton grinders and lappers the Norton No. 2 *Straddle-Bearing* Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

You'll find plenty of proof of that in the modern construction of this newest machine of its type. *Straddle* support of spindle bearings adds strength and ability to take tough jobs . . . the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

Many other features, resulting in outstanding performance advantages, are described in this four-page message. Call your Norton Sales Engineer, a trained expert in the grinding field, for consultation on how these features can benefit your production. Or write to Norton Company — addresses on back page — for Catalog 1328.

Centerless Grinder economy



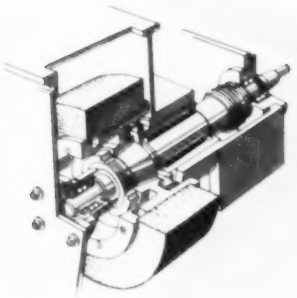
10 High Points that mean high performance

(1) Extra strong Straddle-Bearing support of grinding wheel spindle enables holding close tolerances at high production rates. **(2) Work rest saves time.** It eliminates adjustment by following regulating wheel head when head is swivelled to correct taper. **(3) Easy changes in work support blade settings** are made by turning simple adjusting screws. **(4) Balanced, smoothly operating wheel feed hand wheel,** readily shows amount of movement obtained and has lever to facilitate manual plunge grinding. **(5) Forward-back adjustment of regulating wheel position** is easy with this wheel, which also shows amount of movement secured. **(6) Simplified tilting of wheel head** is obtained by turning adjusting screws at rear of head. **(7) Regulating wheel grinding speeds,** adjustable within range of 8 to 66 rpm, are quickly produced by turning this knob. **(8) Supplementary manual feed control** for in-feed jobs is done with this large, conveniently located hand lever. **(9) Grinding wheel changes are speeded** by swinging back the combination spindle bearing support bracket and wheel-guard cover. **(10) Quick checking of electrical controls** is made possible by mounting controls in this elevated enclosure.

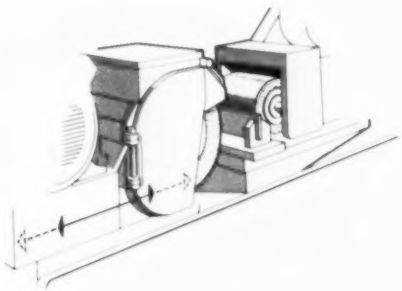
District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit.
In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

NORTON
GRINDERS and LAPPERS

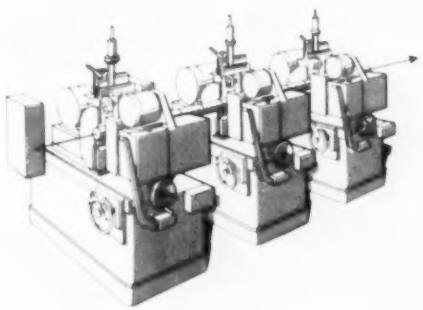
3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING



Straddle-Bearing Spindle Support, in both grinding and regulating wheels, provides extra strength. Combined with the inherent rigidity of Norton spindles this boosts capacity to take heaviest cutting pressures, while permitting fast grinding to close tolerances under all conditions.



Mobile Grinding Wheel Head, with wheel mounted between head ways and feed screw located beneath wheel center for ideal balance, provides instant response to signals. This results in especially fast sizing, one of many important advantages over fixed head operation.

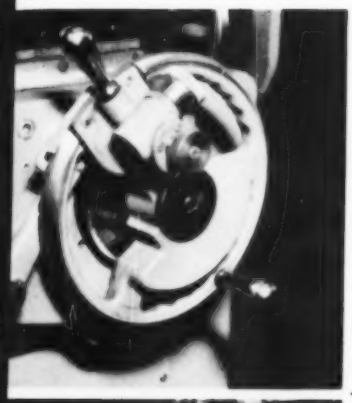


Work Loading Alignment is never disturbed by wear of either grinding or regulating wheel . . . neither is the alignment of the work rest blade. Movable heads for both grinding and regulating wheels make this advantage possible . . . and especially time-saving in a battery set-up.

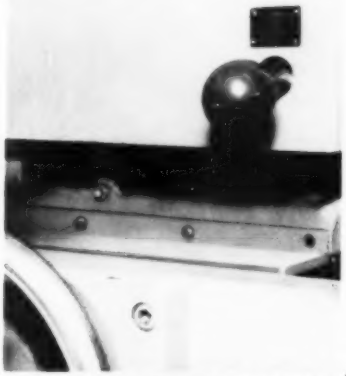
Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

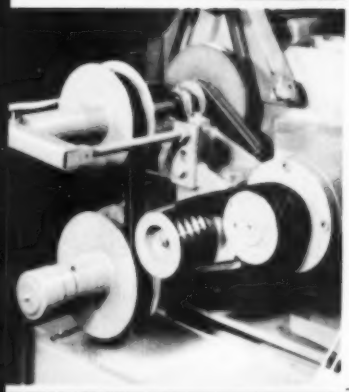
. . . 6 more features that make the Norton *Straddle-Bearing* Centerless Grinder the most modern newcomer



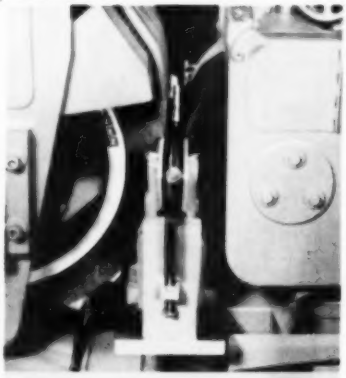
Easy Fine-Increment Setting. Wheel feed hand wheel has the Norton click-count index which quickly adjusts work diameter reductions in increments as fine as 50 millionths of an inch — and eliminates need for depending on visual care in setting.



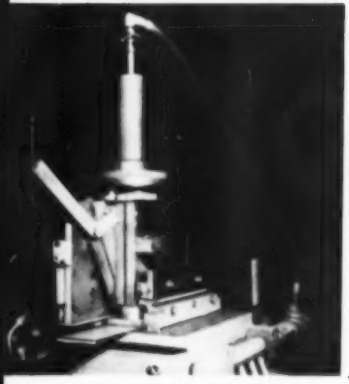
Fast Regulating Wheel Speed Change, to the rate for either truing or grinding, is made without fuss or bother simply by pushing this knob. Change-over is extremely fast and there is a direct return to speeds previously set for each function.



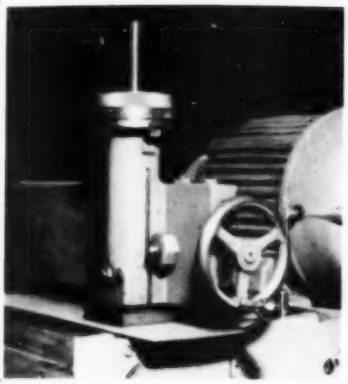
Regulating Wheel Drive. Infinitely variable grinding speeds assured by variable pitch sheaves, with a separate, high speed V-belt drive for truing. Time-saver push-pull knob selects pre-set grinding speed or truing speed.



Work Rest. This moves with regulating wheel slide for taper correction. No time-loss for separate setting.



Effortless Grinding Wheel Truing is done by an automatic wheel head mounted device. This will true a ninety-degree angle, quickly and accurately, without the usual need for hand "boosting" or costly automatic "boosting" equipment.



Regulating Wheel Truing Device. This easily operated mechanism is mounted on the regulating wheel head. Since truing is seldom required on the Norton No. 2 Centerless Grinder, the standard truing device is operated by hand. A power-operated device is available at extra cost.

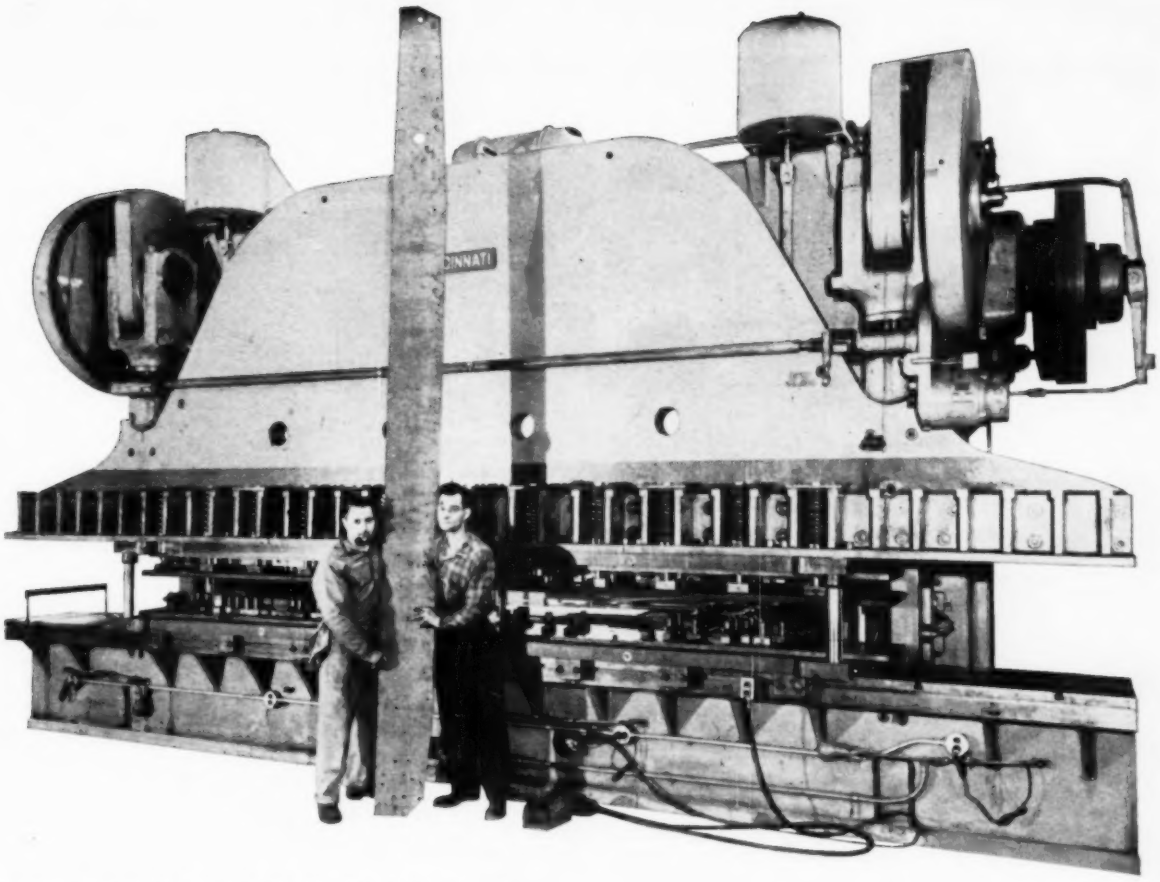
There's no guesswork about this newest Norton grinder the No. 2 *Straddle-Bearing* Centerless. The features described and illustrated in these four pages have been engineered into reality — and are working out as a team coordinated to help you produce more at lower cost. *Remember: this newest Norton development is ready for immediate delivery.* Get the whole story of what it can do for you from NORTON COMPANY, Machine Div., Worcester 6, Massachusetts. *District Offices:* Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co. Ltd., Toronto 5.

NORTON

GRINDERS and LAPPERS

Making better products
. . . to make your products better

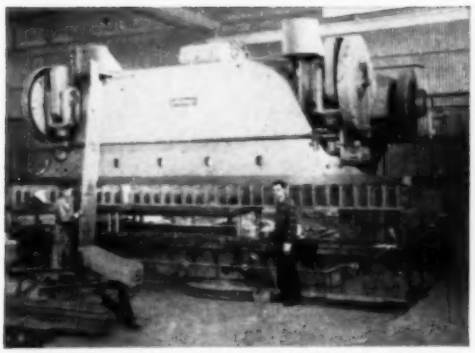
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro Chemicals — **BEHR MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes



Punching floor-to-floor time cut from 36 to 1⅓ minutes.

Photos courtesy Fort Wayne Structural Steel Co., Inc.

70 minutes cut to 2.6 min.



Blanking floor-to-floor time cut from 34 to 1¼ minutes.

In combined blanking and punching operations, production time has been cut 96.2% on these long truck side rail reinforcements, thanks to the versatility of this Cincinnati® All-Steel Press Brake.

Operating data, furnished by John L. Hayner, President of Fort Wayne Structural Steel Co., Inc., show how his company slashed production costs so substantially.

They decreased floor-to-floor time from 34 minutes to 1¼ minutes on blanking ¼" C1010 Steel with a 202" cutting edge. By punching 130 holes per stroke, they reduced floor-to-floor time from 36 minutes to 1⅓ minutes.

Talk with our Application Engineering department about applying a time-cutting Cincinnati Press Brake in your shop. It can be the most profitable decision you've made this year. Write Department A for Press Brake catalog.

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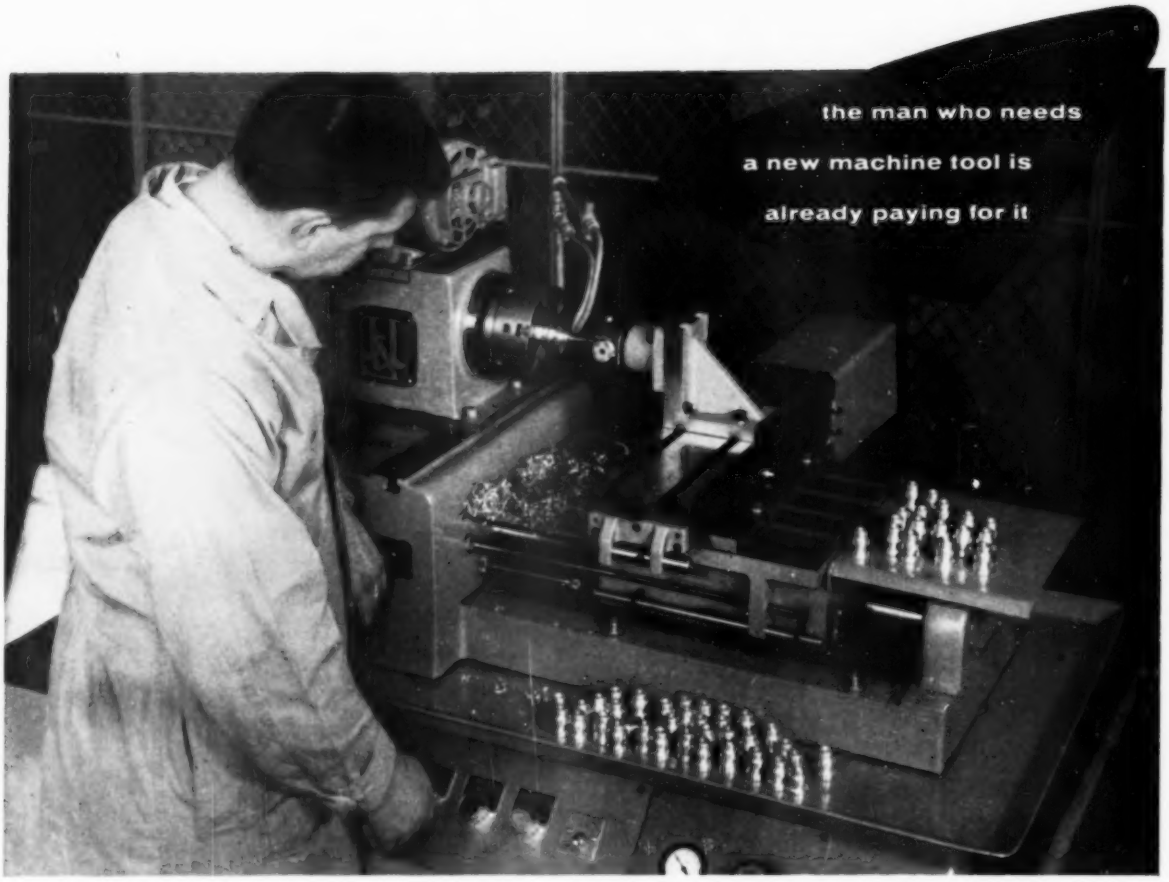
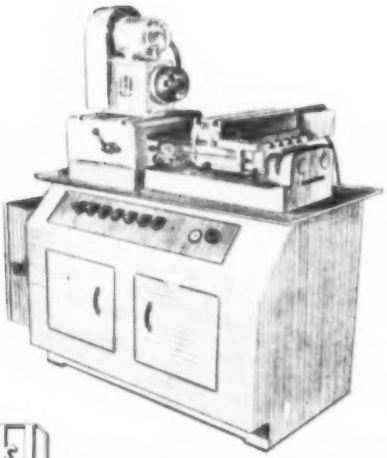


"Stingiest" Machine ever made

The J & L Precision Boring Machine is a mechanical tightwad: "Savings" for the owner are written all over it.

To begin with, its purchase price is far less than you would guess. Then, after it is set up, you find that just about anyone can handle its push button operation. Its simple design doesn't require expensive maintenance either.



This machine's "tightness" extends even to the spindle. It's not only extremely accurate, but also allows adaptation of various types of tooling. It has a threaded nose that will accept all standard air, or manually operated chucks and an inside taper to accommodate 5C collets.

Think that's economical? Well this penny pincher will turn, face and bore at high production rates, yet, because tooling combinations can be shifted quickly, it takes care of the short runs too.

One other thing about the J & L Precision Boring Machine . . . it has a tendency to push its owners into a higher income bracket. If this prospect leaves you undaunted, write for further information.

JONES & LAMSON Machine Company • Dept. 710, 518 Clinton St., Springfield, Vt.

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2 and 3-WAY PILOT VALVES (Timed or Fixed, Normally Open or Normally Closed)
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AND NOW...

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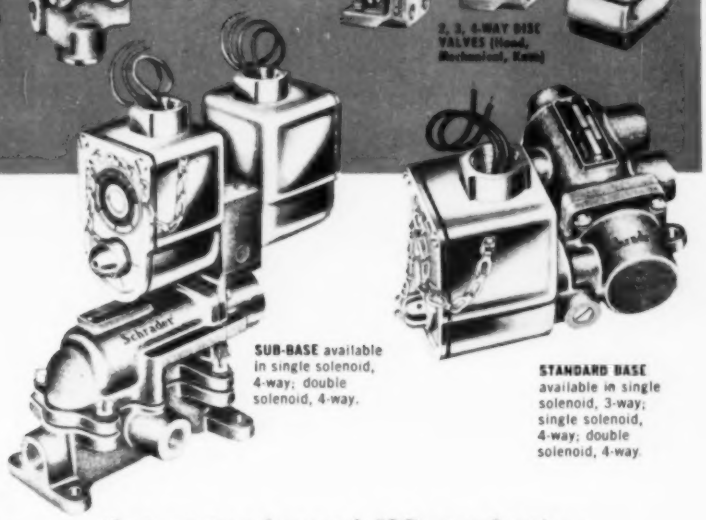
..... that meet and exceed JIC specifications



SUB-BASE available in single solenoid, 4-way; double solenoid, 4-way.

STANDARD BASE available in single solenoid, 3-way; single solenoid, 4-way; double solenoid, 4-way.

New JIC Solenoid Valves are compact, rugged, fast-and-easy to install. Roomy junction boxes fit space requirements with 90° rotation. Can be operated in case of current failure, by hand. Safe, recessed override button prevents accidental operation. Electrical system completely sealed against dust, oil.

Schrader's complete line of air valves allow you a freer hand in planning air circuits for your applications. Besides almost unlimited choice of size, style and actuation method, you get these extras in every Schrader valve you buy:

- All parts are designed for maximum air flow, longest service life; simplicity of replacement; interchangeability.
- Schrader Valves feature tough, practical design, precision construction, and are individually tested to full ratings.
- Performance has been proved by years of use in hundreds of plants. All Schrader Valves can operate with Schrader (JIC) Square End Cylinders perfectly.

Use the full Schrader line to do your air control selecting. Your Schrader distributor can help you pinpoint what you need. For more data write:

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QUALITY AIR CONTROL PRODUCTS

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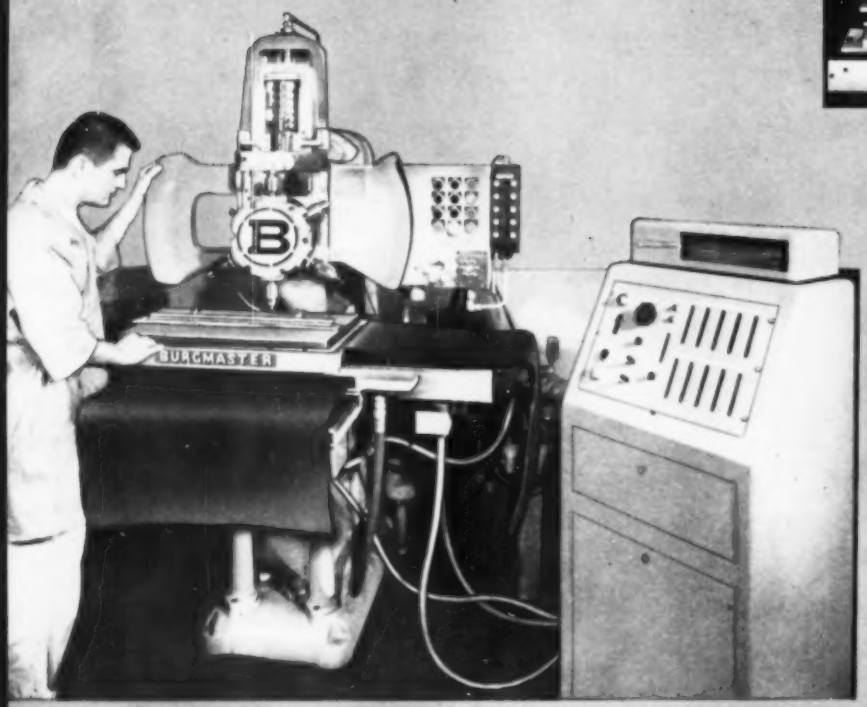
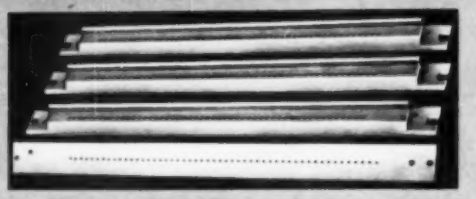
CIRCLE 206 READER SERVICE CARD ▶

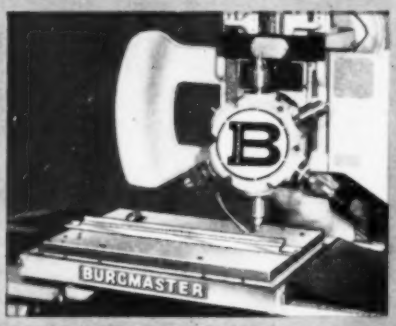
33% More Parts with 50% Less

BURGMASTER tape controlled





Electronic parts showing the 2 locating holes, 2 bolt holes and 51 precision holes, having 5 operations which are held to ±002" non-accumulative error from first tooling hole.



Close-up showing simple standard tools and Fixture used for holding parts while being precision machined on the Burgmaster Tape Controlled Turret Drill.

Parts are programmed by listing the operations, spindle number and X and Y coordinate decimal dimensions in the desired order of machining. This data, in the form of digits, is then punched into the tape in command blocks which include a hole location, the spindle number and any auxiliary function. Programming can be done at the average rate of 1 command block per minute and Tape punching at the rate of 1-4 locations per minute.

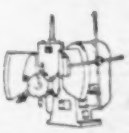
Machine set-up is simple and fast. In this case a sub-base is mounted on the table and locating holes for dowel pins are bored into coordinated positions with the desired hole pattern to be drilled. More complicated parts require holding Fixtures which locate on the table in a center keyway. The average job can be put on the table in approximately 30-40 minutes. Setting the spindle for depth, rapid approach, and rapid return from standard adjustable cams, and mounting chucks, taper sleeves and cutting tools takes about 8-10 minutes per spindle.

Specialists in High Production Turret Drilling

"O" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ⅜" Capacity



2BF Flange Mounted Power Index ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

Labor, $8,000 Fixtures Eliminated

6 SPINDLE TURRET DRILL

with Automatic Numerical Table Positioning Control

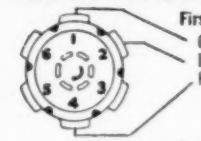
Mechanical Specialties Company, Los Angeles, California, a contract manufacturer of Tooling, Precision Parts, and special machinery, produces 33% more precision electronic parts with 50% less labor and at the same time eliminate the need for 2 expensive $4000 Fixtures. Hand-punched Tape made in their own plant in 2½ hours and a simple holding fixture made in 30 minutes was all that was required to put this job in production. Five operations performed in the 51 holes are held to ±.002 non-accumulated error from the first tooling hole. First the job was run on a jig borer in 6 hours per part. Then it was tooled for Drill press and Milling machine production that required 2 $4000 each Autoindexing Fixtures, 2 men and produced a part in 1½ hours. The Burgmaster Tape Controlled Turret Drill produced the same part in 1.3 hour, and lead time to get into production was greatly reduced.

Maximum Flexible Automation

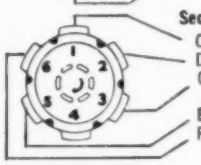
The simplicity, economy and speed with which the Burgmaster Tape Controlled Turret Drilling, Tapping and Boring Machine can be set up to produce a variety of parts with standard tools and simple holding clamps is demonstrated by this job. Set-ups are quickly made from the standard adjustable Burgmaster Controls which include pre-selective spindle speeds, infinitely variable pre-selective feeds, selective rapid approach and return, skip indexing, precision depth control, and simple manual controls for set-up. The numerical control system controls all machine functions, selects spindles in any sequence, automatically positions the table on two axes, clamps the table while machining operations are performed, and controls coolant. Up to six different operations can be performed at any command position without moving the table, or as many cycles using one tool as desired, without indexing. All operations are carried out at their most efficient rate for high finish, precision, speed, and longest tool life.

The savings that can be realized from Automatic Tape Controlled production on small lots or high production is tremendous. Why not get all the facts on your work? There is a Burg direct representative near you. Call him—there is no obligation.

How the Job is Run



First Operation	Diameter
Center Drill	4 holes
Drill 4 holes	5/16
Ream 2 holes	.312 +.0002, —.0000



Second Operation	
Center Drill	51 Holes
Drill 51 holes	#38
C'Bore & Chamfer 1/32" x 45°	—.250x3/16 Deep
End Mill	.156 +.000, —.002
Ream after plating	.1562 +.0005, —.0000

NOTE: Because the table Travel is only 26" long and the part 27" long, it was placed on the table in a diagonal position for machining the 2 Dowel holes, and 2 Bolt holes in the First operation.

Machine: Burgmaster Tape Controlled 6 spindle Turret Drill
Parts: Electronic precision parts
Material: Heat treated steel
Tape Preparation Time: 2½ hours
Machine Set-up Time: 2 hours
Holding: Simple fixture with 2 clamps and 2 dowel pins
Accuracy: 51 holes ±002" non-accumulative error
Former Method: 1st method—jig bores
2nd method—Drill press, Milling Machine, 2 $4000 autoindexing fixtures and 2 men
Former Time: 1st method—6 hours per part
2nd method—1½ hour per part
Present Time: 1.3 hour per part—Floor to Floor
Savings and Advantages: 33% more production, 50% less labor, 2—$4000 Fixtures eliminated, lead time greatly reduced

Write for bulletin describing Burgmaster 6 and 8 spindle Automatic Hydraulic Turret Drills in detail. Twenty-minute 16mm sound film showing Burgmaster turret drills in operations, including, the new automatic positioning table, available from any office.

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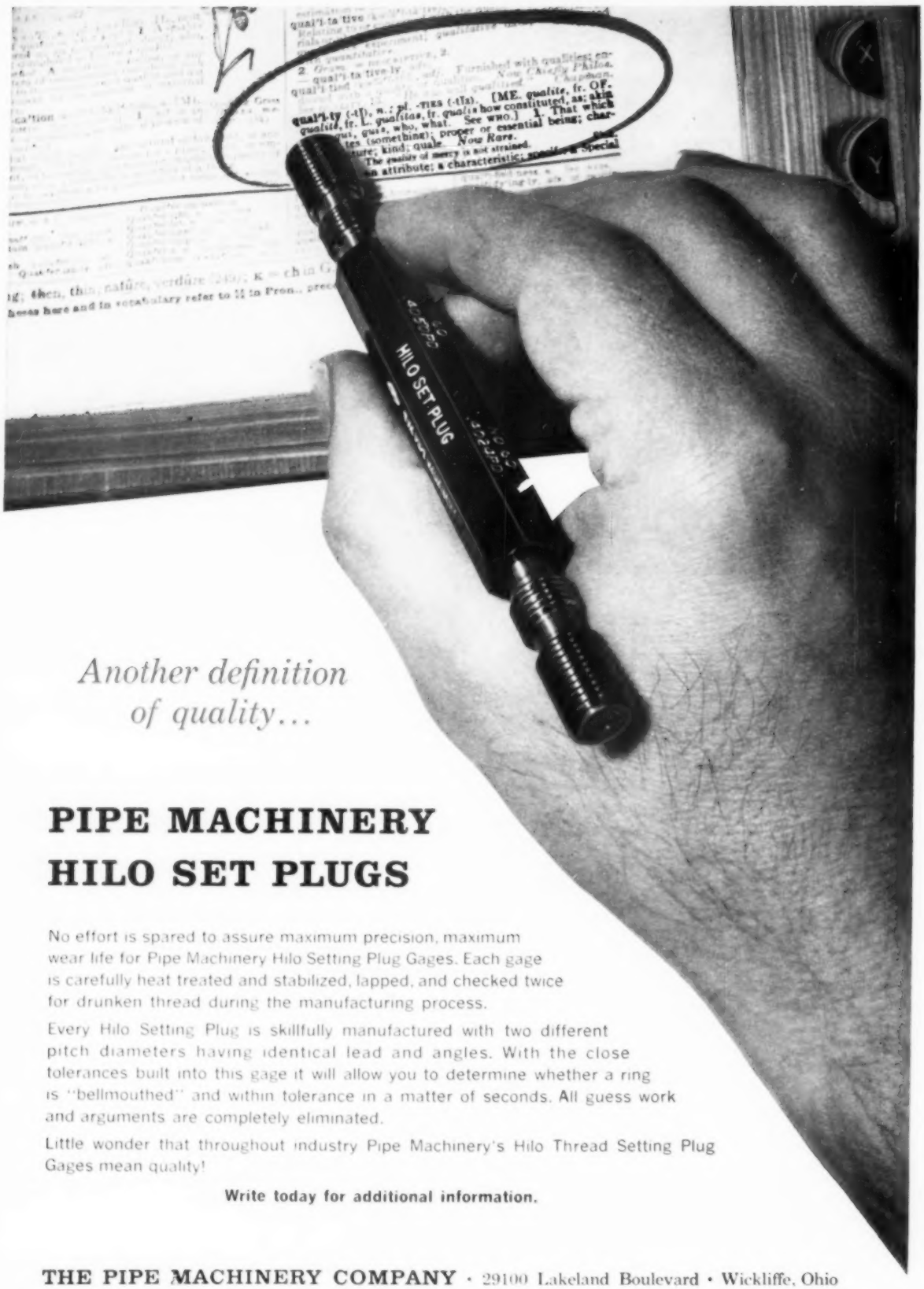

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PIPE MACHINERY HILO SET PLUGS

No effort is spared to assure maximum precision, maximum wear life for Pipe Machinery Hilo Setting Plug Gages. Each gage is carefully heat treated and stabilized, lapped, and checked twice for drunken thread during the manufacturing process.

Every Hilo Setting Plug is skillfully manufactured with two different pitch diameters having identical lead and angles. With the close tolerances built into this gage it will allow you to determine whether a ring is "bellmouthed" and within tolerance in a matter of seconds. All guess work and arguments are completely eliminated.

Little wonder that throughout industry Pipe Machinery's Hilo Thread Setting Plug Gages mean quality!

Write today for additional information.

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HARDINGE
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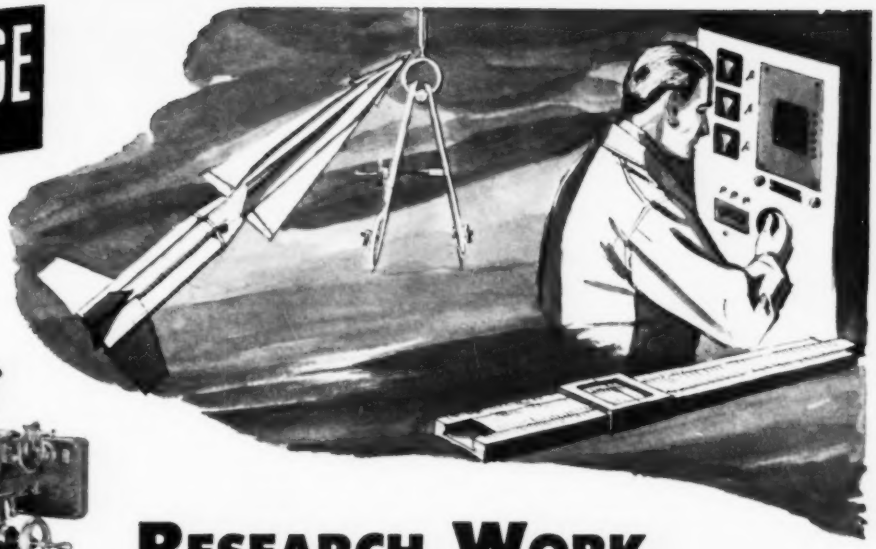
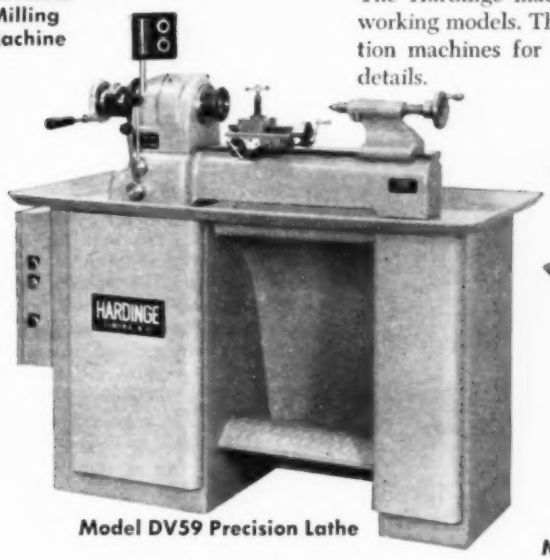


Model UM Universal Milling Machine

RESEARCH WORK
Demands
THE BEST IN MACHINE TOOLS

HARDINGE is the only manufacturer of companion precision machines for milling, straight turning, taper turning, boring, threading and facing with the feature of interchangeable collets, nose fixtures and attachments.

The Hardinge machines illustrated produce precision parts for working models. There are also three Hardinge precision production machines for high speed volume manufacturing – ask for details.



Model DV59 Precision Lathe

Model HLV High Speed Tool Room Lathe

SPECIFICATIONS: *The UM Universal Milling Machine has cutter spindle and spiral dividing head collet capacity of 1-1/16" and a 25 x 6-1/2" swivel table. The DV59 Precision Lathe has 1-1/16" capacity and 9" swing with 17" between centers distance. The HLV Tool Room Lathe has 1-1/16" capacity and 11" swing with 18" between centers distance.*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 8

Subject: Helpful Hints for Successful Tapping

The Drilled Hole:

The drilled hole should be of proper size; drilled straight and not out of round. For most applications, a thread height of 55% for smaller taps and 75% for larger taps will have more than sufficient strength. Excessive thread height may result in torn threads and high tap breakage. Tap drills used in malleable metals such as soft stainless steel, soft aluminum, copper, monel metal etc., should be the largest size permissible because these metals tend to flow to the crest of the minor diameter while being tapped. This results in a small minor diameter after the tapping operation. Where it is possible, bottoming holes should be recessed or drilled deeper than it is necessary to tap. When tapping a hole with a taper pipe tap, it is often helpful to taper ream before tapping. "Go" and "not go" cylindrical plug gages may be used to control the drilled hole size.

The Tapping Machine:

Use a tapping machine and tap holder suited for the work. Check the tapping machine spindle and holder for wear and alignment. If they are worn or out of line, oversize and bellmouth holes may result.

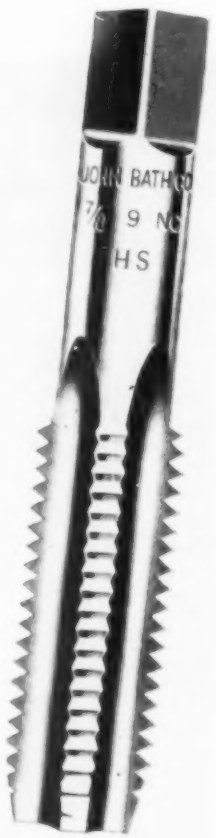
Lubrication:

The best lubricant for tapping depends on many variables such as the material to be tapped, the method of tapping and general conditions. The proper lubricant or cutting fluid can promote longer tap life, size control and higher tapping production. The correct lubricant can generally be determined by an oil company's representative who usually will make a survey and recommend the best lubricant for the specific tapping job.

Tapping Speeds:

There are many factors which affect proper tapping speeds, some of which are:

Material Factors: Thermo-conductivity of the material to be tapped and wall thickness as it affects heat dispersion; variations of carbon content of steel; hard spots in material; depth of hole to be tapped; thread height to be tapped.



Tap Factors: Major diameters, pitch and lead; style of tap; width of lands; amount of hook or rake; length of chamfer.

Mechanical Factors: Type of tapping machine and holder; condition of tapping machine; type of fixture; vertical or horizontal tapping (faster speeds for vertical tapping); method of feeding the tap; cutting fluid used and method of application. Generally the best speed for tapping is the highest speed that conditions permit.

Use a tap with the proper number of flutes, flute design, chamfer and pitch diameter for the job.

Avoid tapping a hole so deep that the flutes of the tap clog tight with chips. Tap breakage will result. When deep hole tapping is necessary, use one or more roughing taps and a finishing tap. Do not rough out a thread too close to the finished size. The finishing tap may bind in the thread and break; will rub instead of cut.

When starting to thread a hole, allow the tap to find its own lead. Do not attempt to force or retard the tap . . . this will cause a bellmouth hole.

Sharp taps are a must for successful tapping. Sharpen when necessary with the utmost care on one of the several types of machines on the market designed for this purpose. Do not sharpen taps by hand.

We have listed some of the most common tapping rules but there are many more depending upon the specific tapping job. Bath engineers will recommend proper taps and give tapping advice on application.

Clip and mail coupon NOW!

John Bath & Co., Inc. 22 Mann St., Worcester, Mass.

I would like to receive blueprints on the proper method of sharpening taps. Send to:

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Street _____

City or Town _____ State _____

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22 Mann Street, Worcester, Mass.

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

PHOENIX CUTS COSTS BY MACHINING PIPE FLANGES IN ONE OPERATION

Back-facing attachment on Simplimatic saves operation—machines both ends in one chucking

You'll want to remember this setup. It shows how Phoenix Manufacturing Company, a division of Union Tank Car Company, Catasauqua, Pennsylvania, cut machining time on *tough* steel pipe flange forgings.

Workpieces include welding necks, slip-ons, threaded (less threading) as well as blind pipe flanges. These parts, with bores ranging from 3" to 16", are machined in lots of 25 to 2000 pieces. A back-facing attachment saves time, operations and handling by permitting machining of both ends in one chucking. The entire range is handled with one basic setup on the Gisholt MASTERLINE Simplimatic Automatic Lathe.

Built for rugged cuts, the rigidly tooled Simplimatic offers added time savings because higher cutting speeds and feeds can be used. Here *machining is based on an average boring speed of 450 surface f.p.m. at .0156" feed per spindle revolution, on all part sizes!*

Change-over is especially fast and easy. Pick-off gears provide the new spindle speed. Chuck jaws, tools or holders are adjusted or replaced. *A slide base, machined into the platen table*, and an attached scale permit rapid front tool slide adjustment for various bore diameters. Fine adjustment is obtained by a micrometer screw on the tool block.

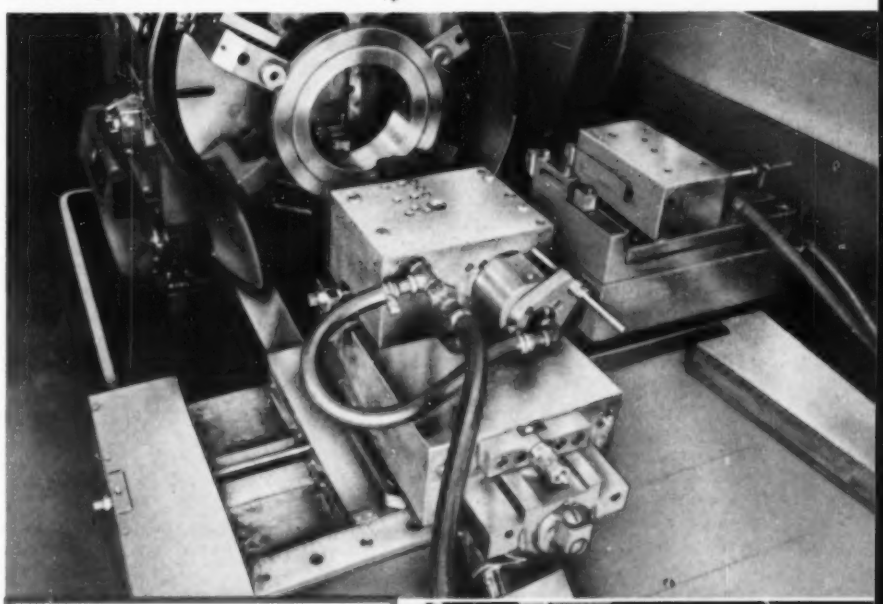
The Simplimatic is shown set up for a 10" welding neck flange with a 16" flange O.D. and a 10" bore.

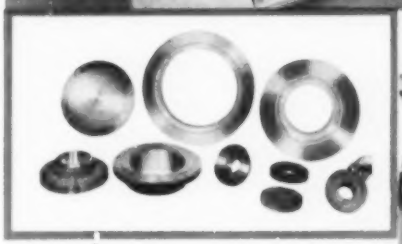
Work locates against the back of the flange face and is held on the flange O.D. in a 28", power-wrench-operated, 3-jaw scroll chuck. Front slide tools rough- and finish-bore and form grooves or gasket seal serrations on the flange face, while two tools on the rear slide step-face the flange. As the boring and facing tools reverse-traverse, the back-facing attachment faces and chamfers the neck, completing the operation.

Approximately ½" stock is removed in the boring and ¼" stock removed in the facing operations, totaling 23 pounds. A 125 to 150 micro-inch RMS finish is easily maintained by machine and tooling rigidity and a 2-speed motor. This provides a low speed for grooving or serrating and a high speed for all other operations.

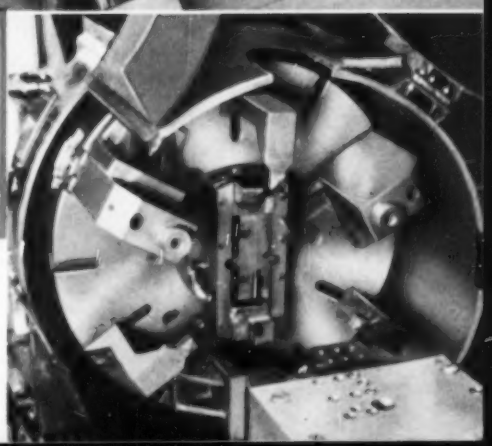
Special slide base, machined into the platen table, speeds front tool slide setting. Back-facing attachment saves additional operations, handling; assures concentricity between back face and bore, parallelism between front and back faces.

Ten-inch welding neck flange and tooling. Back-facing attachment is visible through the workpiece bore. Note the special slide base (at the lower left), machined into the platen table, for quick front tool slide adjustment.





A few of the various tough steel pipe flange forgings handled on this Simplimatic. Welding neck flange featured in story is in bottom row, second from left.



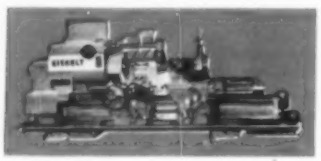
Back-facing attachment and chuck.

HOW UNITED ENGINEERING CUTS TIME 30% ON 4000-LB. JOB

Duplex chucking on rigid, versatile 5L speeds machining, increases accuracy

If your work involves massive parts, heavy stock removal and close tolerances, keep this setup in mind. It shows that the rugged Gisholt MASTERLINE Saddle Type Turret Lathes provide the power, rigidity and versatility to handle problem parts at top efficiency.

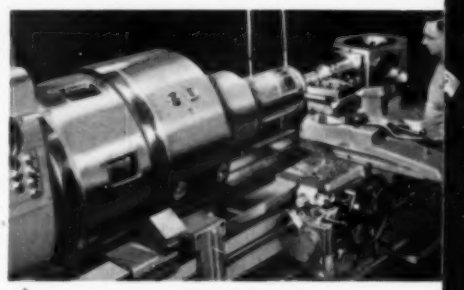
Here United Engineering and Foundry Company, Canton, Ohio, has cut journal machining time 30% or more on 2-ton alloy iron "peanut" rolls. A fixed-center, 5L Saddle Type Turret Lathe is used. A 60" extended bed and a 12½" spindle bore accommodate the work. Electric controls handle braking, spindle jogging, motor forward and reverse. Pedestal-mounted duplicate controls (not shown) permit the operator to remain in a normal working position throughout machining.



A special duplex chucking fixture grips on the midsection of the roll body. This fixture consists of two 32", 3-jaw, self-centering chucks attached to opposite sides of an intermediate body. This assembly mounts on an adapter that fits the 20"-A1 spindle nose. There are no bearing problems since the 5L headstock has the rigidity to prevent spindle and fixture deflection despite an estimated 18,000 inch-pound bending moment exerted by the 4000-lb. workpiece and fixture.

A turret-mounted revolving center provides work support at the outer end. Machining includes turning two diameters, 11 1/32" x 17⅞" long, 10 31/32" x 1⅛" long—forming a groove 1¼" wide by ⅜" deep, and an 11/16" radius to blend the journal with the main roll body—and chamfering. The roll is then turned, end for end, to machine the opposite journal. Both ends are machined, with 325 pounds of tough alloy iron removed, in just three hours and 45 minutes, f.t.f. time.

Duplex chucking fixture simplifies job. Rigid 5L construction prevents deflection that could be caused by an estimated 18,000 inch-pound bending moment exerted by 4000-lb. workpiece. Simple tooling completes part in 30% less time.



Close-up of duplex chucking fixture, extending 32" from the spindle and offering chucking capacity of 17¼" up to the spindle, 12½" through the spindle.

Two-ton alloy iron "peanut" roll handled with this setup. 325 pounds of stock removed in machining both journals in total floor-to-floor time of three hours and 45 minutes.

SETUP SAVES 3 MINUTES PER PART FOR WALWORTH

Two-end machining on No. 5 ram eliminates one operation and extra handling

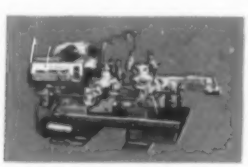
Here is a new approach that cuts costs of machining large, cast steel, lubricated valve plugs in several sizes. Ordinarily, machining at one end and centering at the other require two chuckings and extra equipment. This setup on a Gisholt MASTERLINE No. 5 Ram Type Turret Lathe, with an automatic drive and a spindle-mounted center-drilling attachment, completes both ends in one automatic cycle. Walworth Company, East St. Louis, Illinois, is the manufacturer.

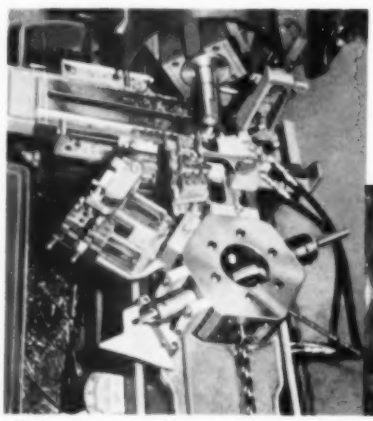
Since the automatic drive converts this ram into an automatic chucking turret lathe, the operator only loads, unloads and chucks. He has ample time to handle a second machine.

Here is the automatic cycle for the first operation on a 4" plug—20⅜" long, 6" maximum diameter. Work is held in a 15", 2-jaw, self-centering chuck. Hex turret tools turn and form the shaft diameters, drill two holes, center and tap in the shaft bore. A rear cross slide tool faces the 6" diameter, blending with the turned shaft. The spindle-mounted center-drilling attachment operates during the automatic cycle, centering the work from the other end. F.t.f. time, 8.4 min.

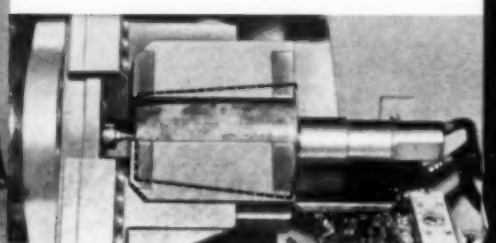
Automatic chip clearing in the 11" and 4⅛" deep holes is provided by periodic drill withdrawal. Rapid traverse quickly returns the drill to the hole bottom before feed is resumed. Class 3 threads are assured by the automatic drive. This maintains sufficient pressure on the turret to eliminate possible "drag" and permits the tap to maintain its own natural lead.

Center-drilling attachment permits machining both ends in one chucking, eliminates separate centering, reduces handling 50%. Automatic drive saves time, doubles operator productivity.





Tooling setup on 4", cast steel, lubricated valve plug. Part shown just after finish-turning of shaft diameters and facing of plug body from rear of cross slide. Note 2-jaw, self-centering chuck.



Workpiece in 2-jaw, self-centering chuck showing surfaces machined at both ends. Note spindle-mounted center-drilling attachment at left. Dotted lines show outline of plug body.

BAKER OIL TOOLS, INC., SAVES 35% ON NINE PARTS

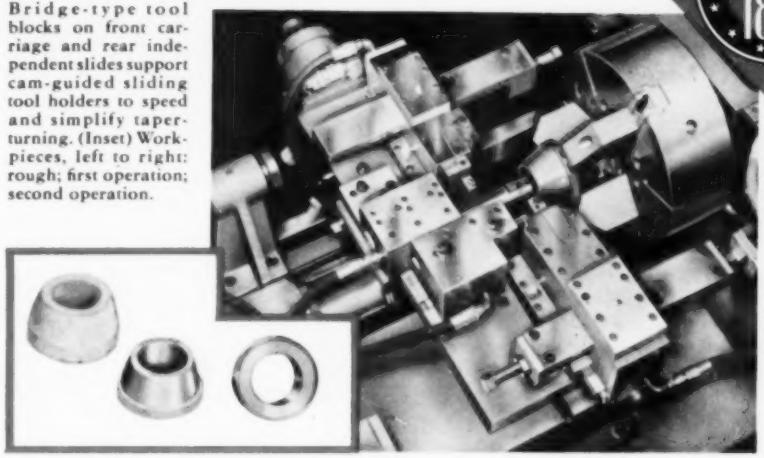
Cam-guided tool holders on No. 12 cut short-run costs

Costs going up on short runs of similar parts? If so, this setup on two Gisholt MASTERLINE No. 12 Automatic Production Lathes will interest you. In use at Baker Oil Tools, Inc., Los Angeles, California, it has cut machining time 35% on nine sizes of cast iron upper cones. These cones are used in bridge plugs and retainer production packers. Lots range from 50 to 500 pieces.

The typical part shown is 2¾" long. The O.D. tapers from 5" to 3¾". Tooling for the first operation (shown) includes special bridge-type tool blocks on the front carriage and rear independent slides. Each block contains a cam-guided sliding tool holder used to turn the 14° tapered cone O.D. Separate, adjustable tool blocks on each slide handle additional surfaces.

Work is located against the back face and held on the O.D. in a 15", 3-jaw air chuck. During the automatic cycle, rear independent slide tools rough-turn the tapered O.D. and shave-face the cone end. At the same time, front carriage tools rough- and finish-bore and chamfer I.D. and O.D. edges while the tapered O.D. is finish-turned. Time, 2.1 min. f.t.f.

For the final operation on the second No. 12, the work is located against the machined face and chucked on an air-operated mandrel.



Bridge-type tool blocks on front carriage and rear independent slides support cam-guided sliding tool holders to speed and simplify taper-turning. (Inset) Workpieces, left to right: rough; first operation; second operation.

Front carriage tools face the end and a co-bore. Rear independent slide tools rough- and finish-turn the straight O.D., radius the O.D. edge, and chamfer the bore and the rim I.D.'s. Time, just .8 minutes f.t.f.

Change-over to accommodate different sizes on either machine requires less than one hour.

Bridge-type blocks with cam-guided tool holders speed taper-turning. No. 12 flexibility permits use of other standard tools that machine additional surfaces, accounting for the 35% time savings.

Versatility offered by No. 12, as demonstrated in this setup, will cut your costs on long or short runs. Contact your Gisholt Representative or write for new No. 12 Catalog, Form 1213.

ECCENTRIC CAMS SUPERFINISHED 25% FASTER BY DENISON ENGINEERING

Superfinishing is not limited to cylindrical bores or round parts

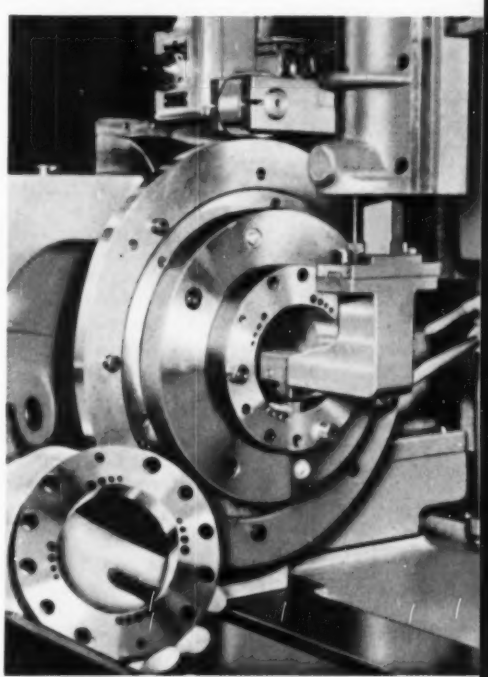
Here smart tooling and machine flexibility provide new economy in finishing the eccentric I.D.'s of hardened steel cam rings. This setup on a Gisholt MASTERLINE 51-A General-Purpose Superfinisher cut finishing time 25%. It also improved quality and lengthened service life on these problem parts for Denison Engineering Division of American Brake Shoe Company, Delaware, Ohio.

Fifty-five different part sizes are handled in lots ranging from 50 to 1000 pieces. Special tooling consists of a spindle-mounted master cam and a cam follower arm, linked to the Superfinish stone-carrying quill. This permits the stone to follow the eccentric cam ring I.D. The headstock is raised to provide 16½" swing for the largest master cam.

Parts are located in proper relation to the master cam by pins on a spindle-mounted face plate. Here is the sequence: The Superfinishing stone moves longitudinally to enter the bore; it then moves down to contact the work I.D. and start the automatic cycle. Constant hydraulic pressure is maintained on the stone. This assures uniform contact with the work I.D. independent of the "rise" and "fall" of the master cam. The stone reciprocates while the work rotates. Surface is reduced from 30-35 to 10 micro-inches RMS (removing only 0.0003" material) in just 1.5 min., f.t.f.

Spindle-mounted eccentric cam with cam follower linked to Superfinish stone-carrying quill cuts eccentric bore finishing time 25%. Superfinish improves quality and lengthens service life of parts.

Ordinarily used for cylindrical or flat work, 51-A Superfinisher with spindle-mounted master cam and follower arrangement Superfinishes eccentric cam ring I.D. Note follower at top of master cam that controls "rise" and "fall" of Superfinishing stone on offset holder.



MACHINES WITH NEW MACHINE GUARANTEE

MASTERLINE
GISHOLT SINCE 1887

AUTOMATIC TURRET LATHE SAVES SIX WAYS

Eight-sided turret on Fastermatic saves operations on large parts for Goodyear Aircraft Corp.

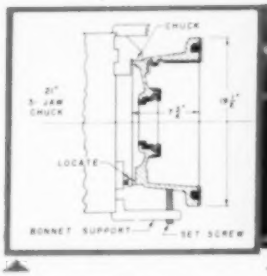
The automatic approach is often overlooked when machining large parts. But, when properly applied, it offers substantial savings in equipment costs, floor space and material handling. In addition, here's how it cut machining time, and improved surface finish and tool life for Goodyear Aircraft Corp., Wheel and Brake Division, Akron, Ohio.

The job: a variety of large magnesium and aluminum alloy airplane wheel halves. Formerly these parts were produced on larger, more expensive, manually operated vertical turret lathes. Now they are machined on a single lower-cost Gisholt MASTERLINE 2F Fastermatic Automatic Chucking Turret Lathe, with 29½" swing to handle the "oversize" parts. An octagon turret carries all tools, eliminating the need for a front and rear cross slide carriage. An automatic chip conveyor reduces chip clearing time and pays off in extra pieces during each work shift.

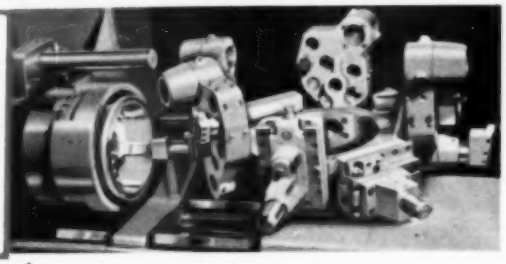
Twenty-two different wheel halves are handled with one basic setup. The 19½"-diameter, 7¾"-wide, inboard wheel half shown is typical. The drawing indicates how it is chucked, located and supported in a special bonnet mounted on the chuck face.

All surfaces shown in black, including severe interrupted and heavy forming cuts, are made from overhead-piloted, multiple-tool holders. Reverse feed eliminates tool tracks and provides a 15 micro-inch RMS finish on critical bearing bore surfaces.

Cross-facing, recessing and grooving, shown in gray, are handled by turret-mounted slide tools. The turret traverses forward against a dead stop and holds, locating the slide tools for length. Cross-feed is provided by a pusher rod on a back-facing attachment. Withdrawal of the rod combines with reverse-traverse of the turret for automatic tool relief.

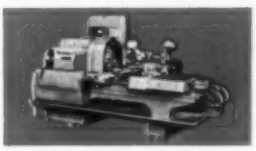


Surfaces machined. Note severe interrupted and heavy forming cuts.



Chuck with bonnet support fixture. Piloted, multiple-tool holders and rugged slide tools on rigid Fastermatic produce fine finish with long tool life on severe interrupted and heavy forming cuts. Guarding has been removed to show tooling.

Octagon turret and 29½" swing allow 2F Fastermatic to replace hand-operated vertical turret lathes. Operator has ample time for other work during automatic cycle.



FAIRFIELD MANUFACTURING CO. BALANCES FOR QUALITY-PLUS

Gisholt 1SV1 Balancer provides mass-production economy on job-lots

Precision balancing of gears is one of the quality-plus features offered by Fairfield Mfg. Co., Lafayette, Indiana.

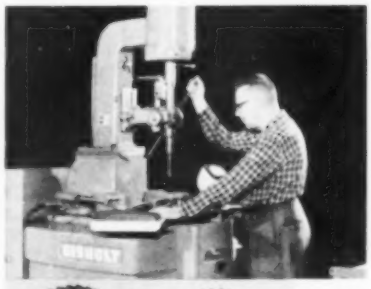
Mass-production economy is obtained on long- or short-run work using a standard Gisholt MASTERLINE 1SV1 Vertical Balancing Machine. The 1SV1 handles parts from two to 50 pounds, 17½" or less in diameter. It is ideal for balancing differential, bevel and spur gears, or similar parts that generally require only a single-plane, static balancing.

Tooling is relatively simple and inexpensive. Work is placed on adapters or expanding mandrel-type arbors that support and drive. A strobe lamp indicates the exact angle of unbalance on a numbered disc which rotates with the work. A direct-reading amount meter eliminates guesswork by showing the exact amount of unbalance in terms of drilling depth required for balancing.

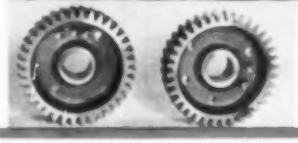
Extra handling for correction is eliminated since drilling equipment is mounted on the balancer. This permits the operator to measure the amount of unbalance, locate the angle, correct by drilling, and rotate the part again for final inspection—all in one fast, combined operation. A simple scale assures accurate adjustment for various work diameters.

The gear shown here, an automotive supercharger component, is typical. Diameter, 4.068"; width, $1\frac{11}{32}$"; weight, 3.5 lb. Lots range from 200 to 500 pieces. Average setup time is only 15 minutes. Web thickness limits correction drilling to a ⅜"-diameter by $\frac{3}{16}$"-deep hole, at a 2½" correction radius. Parts with large amounts of unbalance may require more than one hole. Despite this limitation, single-plane static unbalance is measured, corrected and inspected in an average of only 1.28 minutes, f.t.f.

Integral correction drilling equipment permits location and measurement of unbalance, plus correction and inspection, in one fast handling. It saves time and eliminates chance of error with one operator performing all operations.



Gisholt MASTERLINE 1SV1 Vertical Balancing Machine with integral correction drilling equipment. Drill column adjusts in or out for various work diameters. Simple adapters or mandrels are used to support and drive the parts.



3½-lb. automotive supercharger gear balanced in lots of 200 to 500 pieces. Setup time is only 15 minutes. Unbalance is measured, corrected and inspected in 1.28 minutes, f.t.f.

No. 7-859
739

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

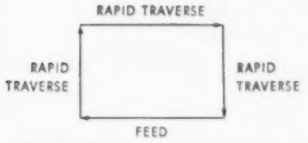
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

How to increase productivity with...

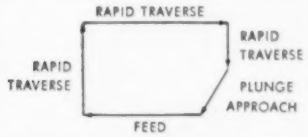
Multicycle Hobbing

Any one of these automatic cycles can be selected simply by turning a switch on the control panel.



SQUARE CYCLE – automatic version of the conventional hobbing cycle.

PLUNGE CYCLE – automatic vertical feed for cutting worm gears.



PLUNGE-APPROACH CYCLE – combination of "plunge" and "square."

Automatic cycling plus the opportunity to greatly reduce approach time in many cases makes the Multicycle version of the Barber-Colman No. 16-16 Hobbing Machine a high-production machine, and yet it is extremely versatile.

Reduce approach time

The new Multicycle machine offers three different automatic cycles (see sketch). Any of these can be selected simply by turning a switch. With the plunge-approach cycle for cutting helical gears and worms (or when using large, multiple-thread hobs), you can greatly reduce long approach time. With the push of a button, cam vertical feed and conventional horizontal feed cycle automatically. The hob starts cutting at full depth faster. Clamping and unclamping of the workslide is automatic. The operator just loads and unloads the work.

Automatic machines can be versatile, too!

To cut worm gears, turn the selector switch to "plunge," disengage the feed change gears, turn the dial control to proper cam speed, set the vertical stops, and push the start button. The workslide lowers rapidly to the cutting position. The work feeds slowly to full depth as it is being hobbed, and then dwells for the desired number of revolutions. When the hob stops, the workslide returns to starting position.

Is there a Multicycle machine for you?

You bet there is. These same features are available in the No. 6-10 machine. Additional equipment, such as differential gearing, accessory vertical feed cams, and even full automation, will adapt this precision hobbing machine to almost any job. Send us prints of your gears. We'll give you a complete report on the time saved by a Multicycle machine. Call your nearest Barber-Colman field office or the factory, WO 8-6833.

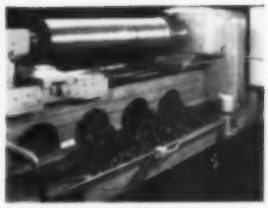
Barber-Colman Company

BARBER COLMAN

71 Loomis Street, Rockford, Illinois

◄CIRCLE 214 READER SERVICE CARD

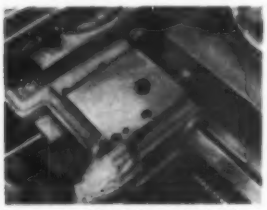
CIRCLE 215 READER SERVICE CARD



Chip flow to the rear of the machine for easy removal.

36 spindle speeds in a range of 8 to 1000 R. P. M.

Four-way variable speed power rapid traverse.



Power tailstock positioning on flame hardened bed ways.

No chip pan obstruction at front of machine.

Tailstock design permits setting compound rest parallel to work axis.

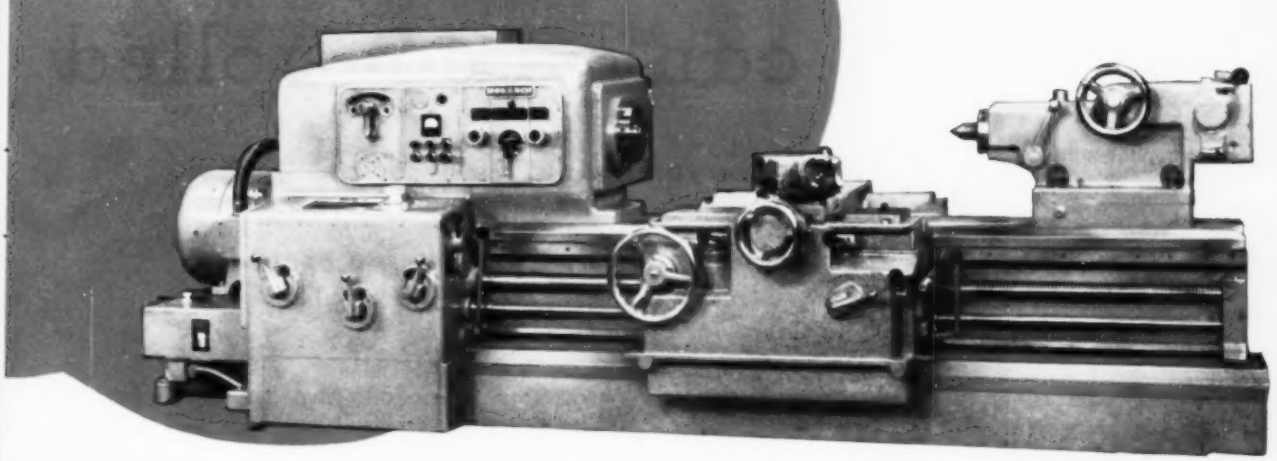
Check the Model 3220, feature for feature, against any other heavy duty lathe of similar swing capacity. Here are the major plus values. Add them up and you get only one answer — greater productivity hour after hour — day after day — year after year. This is worth investigation!

	Monarch Model 3220	Other 25" Or Model 3220 Machines
Number of spindle speeds	36	
Speed range	8 to 1000 R. P. M.	
Surface cutting speed automatically calculated	Yes	
Hole in headstock spindle	3 1/16"	
Spindle jog	Automatic	
Headstock lubrication	Mist	
Attention-free hydraulic clutch and brake	Yes	
Swing over bed and carriage wings	32"	
Bed width	26½"	
Totally enclosed end gearing	Yes	
Four flame hardened and precision ground bed ways	Yes	
Chip flow to rear for easy removal	Yes	
Chip pan obstruction at front	No	
Automatic traveling rod supports	Yes	
Variable speed power rapid traverse to carriage and cross slide	Yes	
Automatic disengagement of apron handwheel and cross feed dial during traverse	Yes	
Apron handwheel and cross feed dial pick-up at same spot after traverse	Yes	
Feed range	.003" to .1683" per rev.	
Backlash eliminator when using taper attachment	Yes	
Tailstock spindle diameter	6½"	
Power tailstock positioning	Yes	
Anti-friction tailstock spindle suitable for drilling, tapping and reaming	Yes	
Tailstock design permits setting compound rest parallel to bed ways	Yes	
Stock removal, cu. in. per minute, up to	92	
Net weight of base length (48") machine	19,660 lbs.	

YOU GET MORE...
YOU PRODUCE MORE

with the Monarch Series 80
Heavy Duty Dyna-Shift Lathe—Model 3220

(OLD DESIGNS DESIGNATED AS 25" LATHES)



You'll suffer — competitively — if you tool up today with yesterday's lathes for the boom of the Soaring Sixties. The Monarch Series 80 is truly the lathe of tomorrow, as are the other new Monarch high production and special purpose lathes. Send for our illustrated Booklet #1603 for full Series 80 information — or state your other interests.

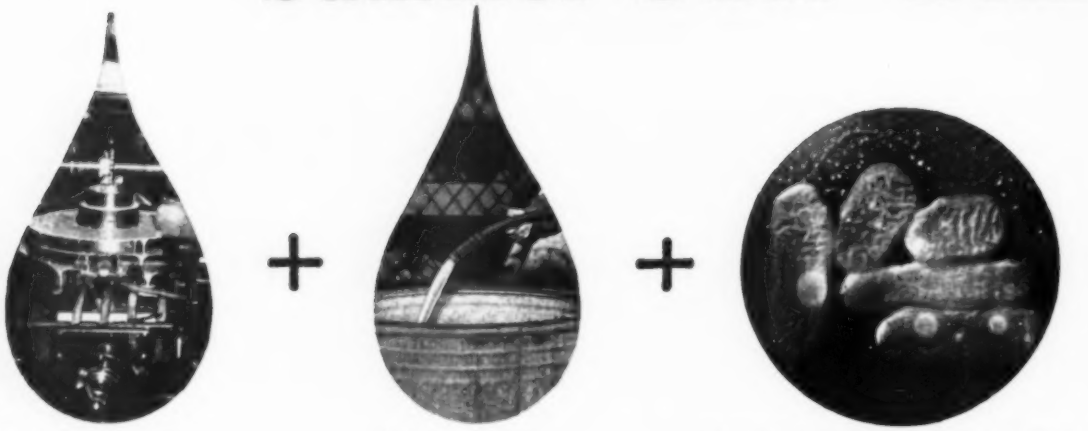
Monarch
TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER

CIRCLE 217 READER SERVICE CARD

"Summer Odor" from



SOLUBLE OIL + WATER + PSEUDOMONADS

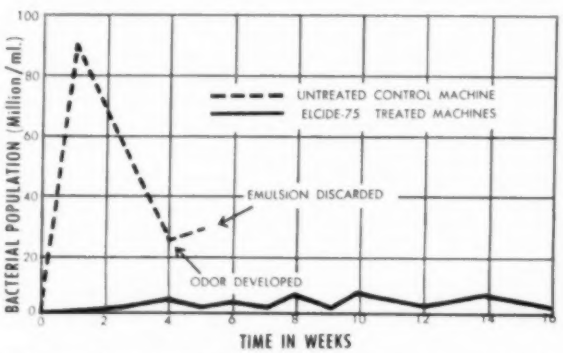
...can be controlled

Nearly everyone has experienced the "rotten egg" smell of spoiled soluble oil emulsions. Here's an explanation of what happens to cause it... and how you can control it with Elcide 75.

THE CAUSE: The oil-and-water mixture of a standard duty soluble oil emulsion produces ideal feeding conditions for certain bacteria. One of the most common types, *pseudomonads*, can be found in all emulsions. Once established, they multiply rapidly . . . especially in warm weather . . . and feed on the emulsion.

As these pseudomonad colonies build up, they set the stage for a secondary contamination by sulfate-reducing bacteria. These bacteria feed on the petroleum sulfonates commonly used as the emulsifying agent in soluble oils. As they multiply, they throw off H_2S, the hydrogen sulfide gas known in metalworking plants as "summer odor."

Unfortunately, the damage from bacterial contamination does not end here. As the odor develops, the bacteria continue feeding on the emulsifier until the emulsion breaks. This process changes the mixture from alkaline in composition to corrosive acid. Other by-products from the bacteria form a slime that clogs screens and filters, and presents certain hygienic hazards.

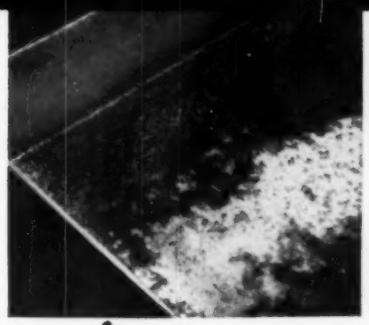


This record of an actual in-plant test shows how untreated emulsion allows rapid bacterial build-up. The downward curve of the untreated emulsion is where secondary contamination by the sulfate-reducing bacteria starts its final destruction. Note the comparison between this and the Elcide 75-treated emulsion which lasted 5½ times longer.

ELI Lilly AND COMPANY • AGRICULTURAL AND INDUSTRIAL PRODUCTS

CIRCLE 218 READER SERVICE CARD

rancid emulsions

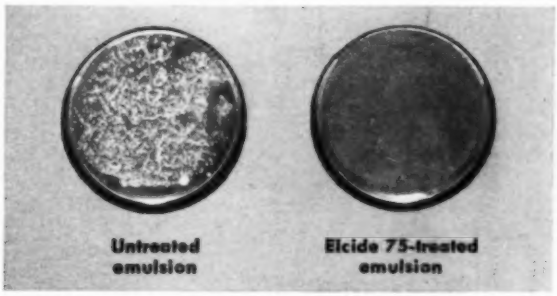


$+ \rightarrow H_2S\uparrow$

SULFATE-REDUCING BACTERIA

(SUMMER ODOR)

with ELCIDE 75



THE CURE: **ELCIDE 75 hits this problem at the very first stage** of bacterial growth. The petri dishes above show the contrast between an untreated emulsion and an emulsion treated with Elcide 75. The light areas in the untreated sample are bacterial colonies. Because Elcide 75 is a new, wide-spectrum bacterial inhibitor, it attacks and controls not only the more common bacteria, but also mutants which frequently develop. Just one ounce of Elcide 75 to each 4 gallons of fresh emulsion breaks the vicious cycle of bacterial growth before it starts . . . thereby greatly extending the useful life of your coolant.

ELCIDE 75 is a reliable way to prevent the waste of frequent emulsion changes. Its wide range of antibacterial action insures a constant control that not only prevents summer odor, but also reduces production costs. Many plants have thoroughly tested Elcide 75 in comparison to untreated emulsions. Their findings indicate Elcide 75-treated emulsions last far longer, reduce downtime and oil concentrate costs, and increase total productivity.

If you have not yet tried Elcide 75 in your plant, we urge you to try it now . . . before the heat of summer further inflates your personnel problems and operating expenses.

PRODUCT SPECIFICATIONS—ELCIDE 75

(Lilly's brand of bacterial inhibitor for cutting fluids)

Active Ingredients—Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium *o*-phenylphenate.

Package	Price per Gal.
1-gal. (4 per case) polyethylene .	$8.50
5-gallon polyethylene	$8.00
55-gallon stainless steel	$6.50

Sold only through selected distributors.

For more information or to place your order, write or phone:

ELCIDE 75™

PATENT PENDING

KEEPS COOLANTS FRESH AS A DAISY!

DIVISION

INDIANAPOLIS 6, INDIANA
Telephone: MElrose 6-2211

CIRCLE 219 READER SERVICE CARD

Photo courtesy LITHO-STRIP CORPORATION, Chicago, Ill.

BONDERIZED ALUMINUM

makes your painted products look better longer

Most famous of all surface treatments for metals—BONDERITE—makes painted aluminum look better longer.

Bonderite on aluminum means fine appearance longer, because it controls corrosion and anchors the paint.

Bonderized and painted aluminum is produced on automated strip lines in which the metal is cleaned, Bonderized and painted, then re-coiled ready for use.

Stamped or roll-formed products are made from pre-painted, Bonderized aluminum coil without loss of paint adhesion, even from the most severe deformation. Here's production efficiency and economy at its best—better products at less cost.

Many Applications of Bonderite for Aluminum

There's more than one type of Bonderite for use on aluminum. In wide use is Bonderite as a base for paint, which adds durability and long life to paint finishes on so many aluminum products.

Another Bonderite produces an attractive green coating, used on many architectural products without further finish.

Protection without changing the characteristic color of the metal is provided by another Bonderite.

There is also a Bonderite, formulated for mixed production, which coats aluminum, steel and zinc.

Bonderite for aluminum meets and exceeds the requirements of Government Specification MIL-C-5541.

Well over two hundred plants—large, medium-sized and small—use these great Parker products on their aluminum production. Better investigate for *your* plant, today!

Aluminum window and screen frame sections Bonderized, painted and formed after painting. No breaks in finish anywhere! (Courtesy, Security Co., Detroit, Mich.)

SEND FOR ILLUSTRATED BULLETIN!—*Free bulletin, with more complete information and details, mailed immediately upon request. Ask for Bulletin A6790, "Bonderite for Aluminum."*

Parker Rust Proof Company

2196 E. MILWAUKEE, DETROIT 11, MICHIGAN

BONDERITE corrosion resistant paint base	BONDERITE and BONDERLUBE aids in cold forming of metals	PARCO COMPOUND rust resistant	PARCO LUBRITE—wear resistant for friction surfaces	TROPICAL—heavy duty maintenance paints since 1883

**Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.*

WELDING TIME ON MISSILE BEAMS CUT IN HALF

"I'VE got something here I'd like to demonstrate for you." George Giangrande, a Lincoln welding engineer, was talking to Mr. S. Wagner, Plant Manager of the Couse Manufacturing Company of Newark, New Jersey.

On a welding application, he had spotted at a previous visit to their plant, Mr. Giangrande proceeded to show Mr. Wagner and Mr. William Wier, the Welding Foreman, how a change in the type of electrode used and the resulting increase in speed would improve the welds, yet cut time and welding costs.

As a result, Couse Manufacturing is now welding missile beams in 45 minutes where it formerly required 90 minutes. The electrode which made this possible is Lincoln Jetweld "1".

"Because of the savings Giangrande was able to realize for us on the missile beams," stated Mr. Wier, "we've asked him to survey our other welding operations. Since then, we've changed procedures for welding on trailer bodies which are now giving us considerable savings through faster welding and less cleaning required."

Helping customers cut costs is an everyday occurrence for the Lincoln man. Because he is a welding engineer, he appraises each welding operation in light of its own particular requirement. He then demonstrates the procedures and *proves* the savings in actual production.

What George Giangrande did for Couse Manufacturing, your Lincoln man can do for you. It's his business to save you money—why don't you give him a ring?

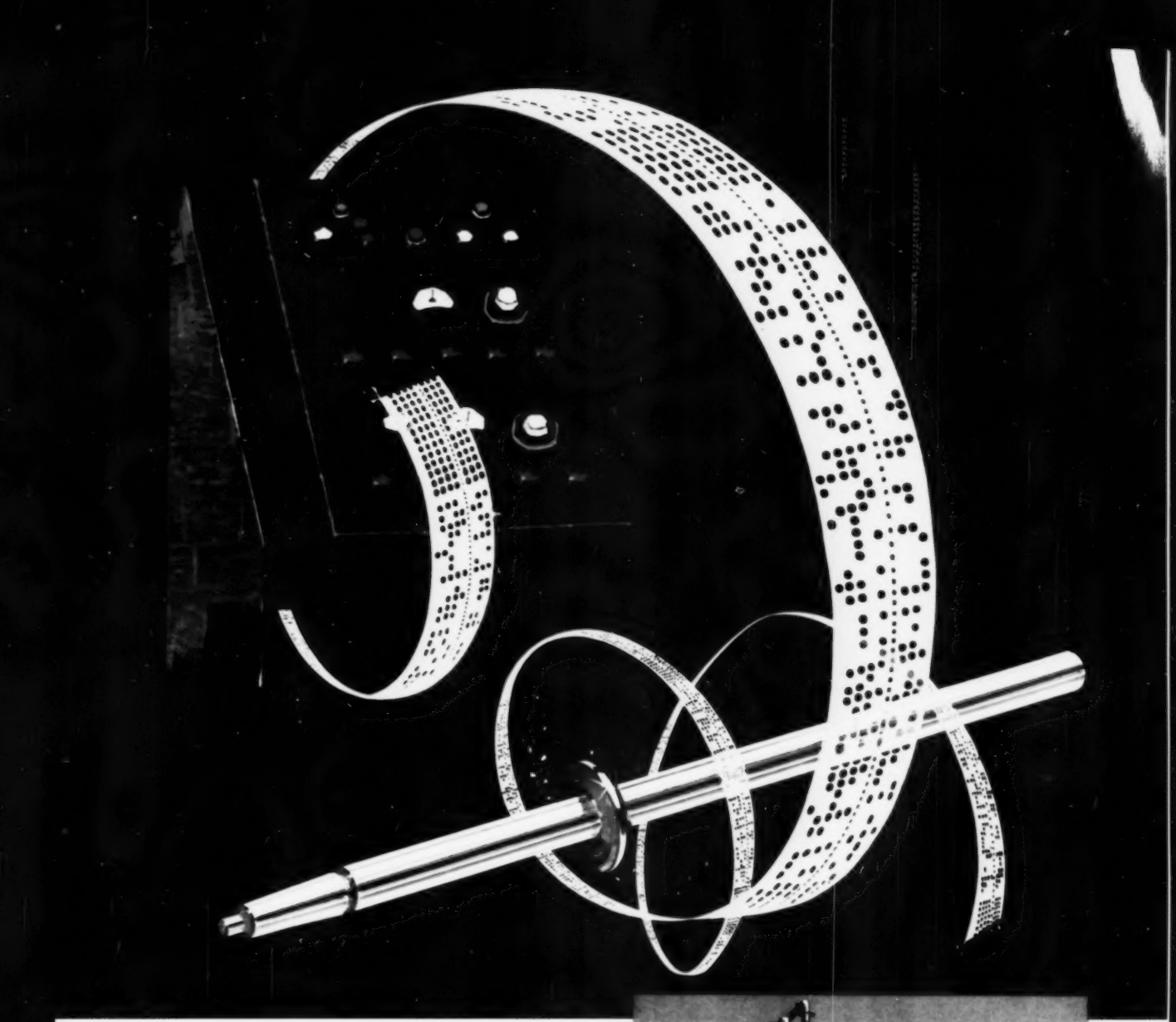
The World's Largest Manufacturer of Arc Welding Equipment

LINCOLN®

THE LINCOLN ELECTRIC COMPANY • DEPT. 2035 • CLEVELAND 17, OHIO

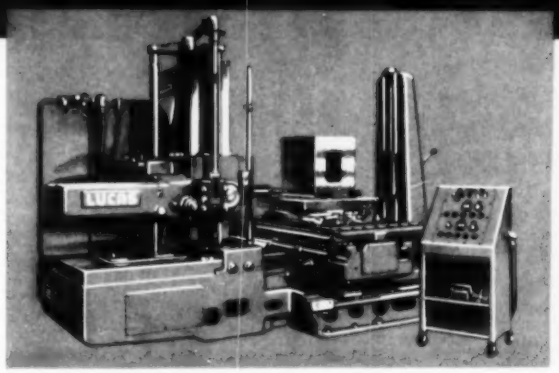
CIRCLE 222 READER SERVICE CARD

CIRCLE 223 READER SERVICE CARD►

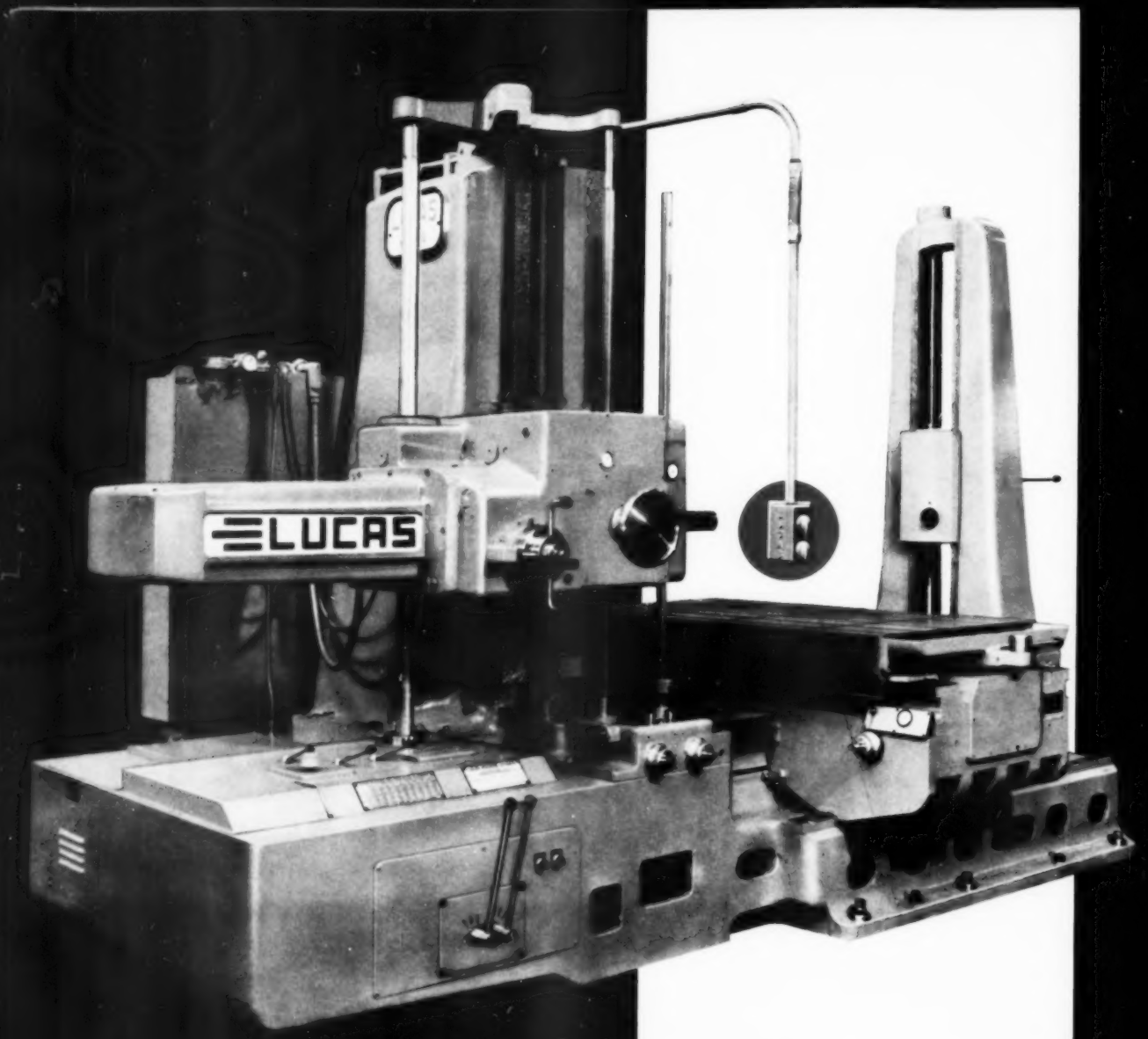


Tape control... certainly!

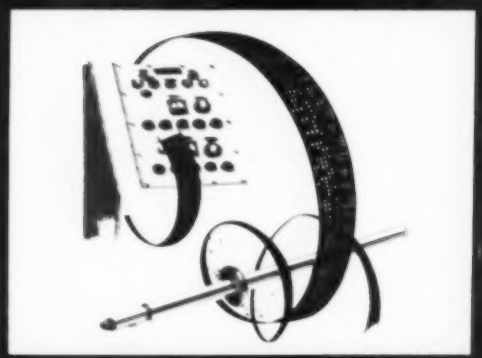
Tape control can readily be applied to any Lucas model, (2 3/4" to 6" diameter spindles) if repetitive operations or complicated one-of-a-kind jobs make this new development advantageous. Lucas tape controlled machines are available with punched tape for N.P.C., magnetic tape for contouring, or tape and tracer control. If you have a profitable use for *any* type or size of horizontal boring, drilling and milling machine (up to 6" spindle capacity) you can get it at its best from the specialist in this type of machine. *Did you ever meet a man who regretted picking a Lucas?*



LUCAS
OF CLEVELAND

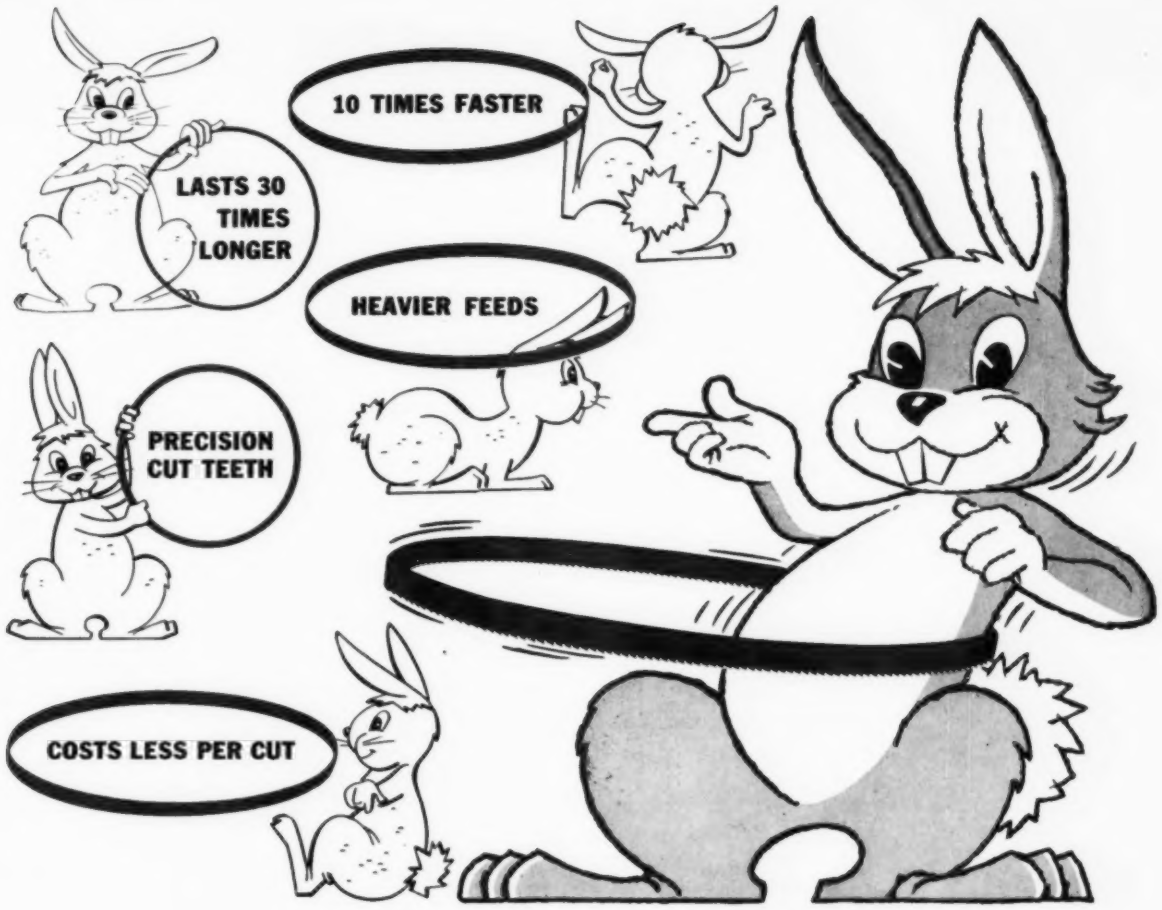


Simplified pendant controls . . .



A Lucas performs the greatest variety of operations possible in any machine tool. Standard models permit control of *all* operations from the pendant. Optional pendant and lever control machines, like the one shown above, combine a simplified pendant with readily accessible levers. Whichever type of control you want—pendant, lever, tape, tracer or any of these in combination—Lucas has it.

LUCAS
OF CLEVELAND



MULTIPLY PRODUCTION

with Blu-Mol® high speed steel band saws

Last 20% longer than other high speed steel bands

After years of development, these new Blu-Mol high speed bands have been exhaustively tested in the laboratory and proved on job after job. For example, on one production run cutting M-2 High Speed Steel, 200 bands were used. Operating at a rate of 2 square inches/minute with a blade speed of 160 feet/minute, the average life of each band was *over 6000 square inches!*

These Blu-Mol high speed bands cost less per cut than any other metal cutting blade. 10 times faster or 30 times longer lasting than carbon steel bands. *High temperature hardness* keeps cutting edge hard even under most punishing conditions. Designed especially for production cut-off work, these high speed blades are the best bands made!

World's broadest, most highly developed line of metal cutting saws

MILLERS FALLS TOOLS
SINCE 1868®

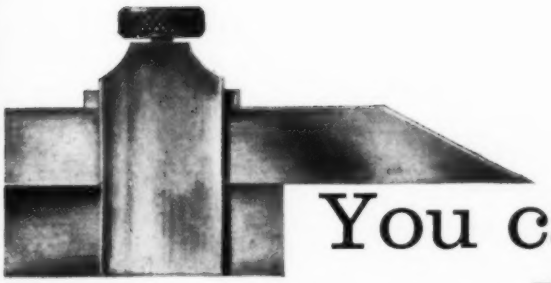
MILLERS FALLS COMPANY, Dept. AM-18, Greenfield, Massachusetts

◄ CIRCLE 224 READER SERVICE CARD

CIRCLE 225 READER SERVICE CARD

The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.



You can produce greater savings than you can buy

You can't recognize a value by its price alone. This is true of all types of grinding wheels and has special significance in diamond wheels in view of their high initial cost.

The price tag on a diamond grinding wheel may appear to be a good "buy," but the real consideration should be what will you get for your money?

Less expensive diamond grinding wheels than Norton wheels may save you money on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — the price you paid is too much.

The only accurate measure of the value of any grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton diamond grinding wheels are worth more to you —

Norton Company introduced all three diamond wheel bond types, does all its own sizing and checking of diamonds — duplicating wheel specification with constant accuracy. Norton certifies the carat content, assuring full value for your money. Whether the diamonds you use in carbide grinding are mined or man-made, Norton gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field. And you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years' abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

Ask him to make an Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems. For example —

Your Norton Man can increase production by pointing out ways for more effective wheel usage. He has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

W-1917

NORTON

ABRASIVES

Making better products... to make your products better

CIRCLE 227 READER SERVICE CARD

STANDARD BROACHES from STOCK

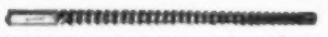
Minute Man

KEYWAY BROACH KIT

In one minute and for as little as one cent you can cut a keyway with the Minute Man Keyway Broach Kit. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

SAVE TIME AND MONEY WITH THESE OTHER STANDARD STOCK BROACHES

SQUARE BROACHES — 1/8" to 3/4" holes



HEXAGON BROACHES — 1/8" to 3/4" holes

ROUND BROACHES — 1/4" to 1" holes

SEND FOR CATALOG AND PRICE LIST

The duMont Corp.
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name .....

Company .....

Address .....

duMont

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Infra-red heaters

Dear Sirs:
On page 97 of the June 1, 1959 issue there appeared mention of "Warmth in Open Buildings," which involved use of gas-operated infra-red heaters.

Could you please advise the name and address of the user so we could get more information on this heating method?

Henry W Josephs
Sarasota, Fla

The heaters mentioned in the article are in use at Bethlehem Fabricators, Bethlehem, Penna. They are manufactured by Perfection Industries, 1135 Ivanhoe, Cleveland, Ohio—Ed.

Dye for plastics

Dear Sirs:
In "Metalworking Report" under the heading, "Dye for Short Runs," a report was made of a process that would dye plastics (*AM*—Feb 9 '59, p3).

We have not been able to find the street address of the company that has this process, Colorite Industrial Dyers of New York, and we would appreciate any information you have in this respect.

E J Schuler
Endicott, NY

Colorite Industrial Dyers is located at 244 West 38th St, New York, NY, and the man to write is Mr Albert Zucherman—Ed.

Handling explosives

Dear Sirs:
A grave error was made in your Special Report No. 474 (*AM*—June 15 '59, p127). On page 131 the following sentence appears: "RDX, for example, is not easily detonated and can be pounded, cut to shape, or even crushed."

Pure RDX is a sensitive high explosive and should never be pounded, cut or crushed unless a hazardous explosion is desired. We have handled tons of material containing RDX, and we would never handle it in any way but with respect.

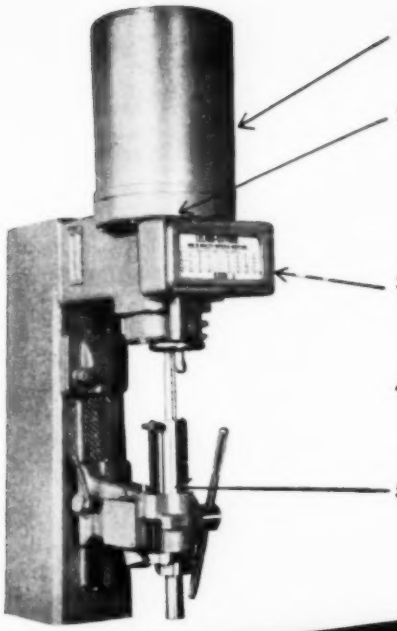
So far, explosive metal forming has a good safety record, so sincerely hope none of your read- has a good safety record, so we

We strongly recommend that any novice in handling explosives

SHOPMATES

N. Jarvis

LOOKIN' FOR A LOST PART IS A POOR EXCUSE FOR SNEAKIN' A SMOKE UNDER YER BENCH··· OR ARE YOU TRYIN' TO GIVE ME A HOT FOOT ??
··· AND WHEN HE GETS UP HE BANGS HIS HEAD ON THE BENCH ···· THE AIR TURNS BLUE ···· HE TEARS HIS HAIR ····
··· TRY AN' FIND A !!* STEEL PART ON A GRAY FLOOR !!
N. JARVIS



1. TOTALLY ENCLOSED MOTOR

Windings and air gap completely protected from dust, dirt, chips.

2. DIRECT DRIVE

Direct drive from four-speed motor to spindle for smooth power transmission. For extreme speed range, can be furnished with back gears. Speeds from 90 RPM up to 3600 with torque multiplication up to six times supplies brute power for large drills, ample speed for drills down to 1/16".

3. INDICATING SHIFT

For positive speed indication. Tells right speed to use for drill sizes in three different SFM ranges. Convenient hand wheel shifts speed without stopping machine.

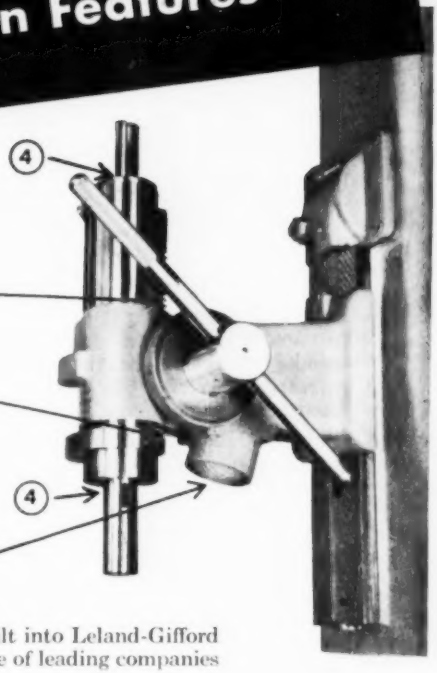
4. OIL MIST LUBRICATION

Radial-thrust ball bearings are constantly and properly lubricated at all speeds by oil mist. Spindle splines lubricated by felt wipers.

5. OVERSIZE SPINDLE QUILL

Oversize quills are 2 3/16" in diameter. Large bearing area maintains accuracy and assures long life.

Only LELAND-GIFFORD Drilling Machines have all these Precision Features



6. INSERTED STEEL RACK

Inserted steel rack prevents radial motion which can cause uneven tooth loads on feed pinion. Also insures accurate alignment when multiple heads are used.

7. BROACHED SLOT

Rack slides in slot precision broached into head.

8. SPINDLE GUARDS

Telescopic guard can be furnished to completely cover the spindle, protect operator from fast-moving multiple splines.

9. BUILT-IN LIGHT

Built into sliding head. Puts the light on the work where it ought to be. Never in the way like makeshift lighting.

Compare the quality, workmanship and precision features built into Leland-Gifford Drilling Machines and you will see why they are the first choice of leading companies for toolroom and production lines.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U. S. A.

Branch Offices:

CHICAGO 5
2515 W. Peterson Ave.

CLEVELAND 22
P. O. Box 853

DETROIT 21
10429 W. McNichols Rd.

INDIANAPOLIS 6
P. O. Box 1051

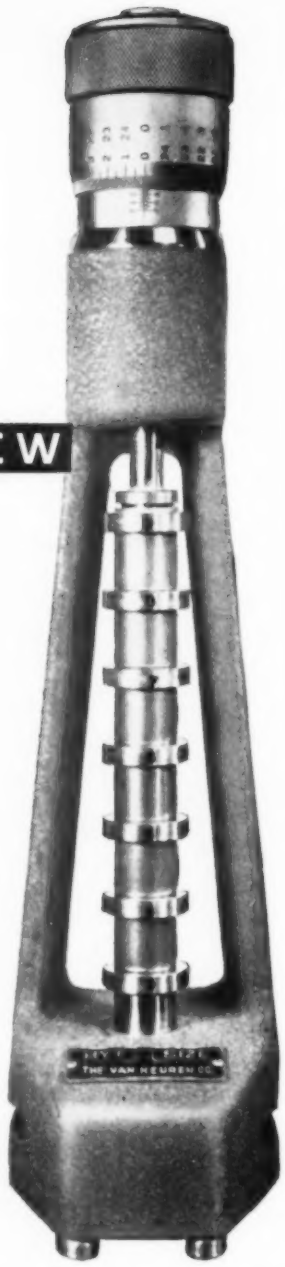
LOS ANGELES
2620 Leonis Blvd., Vernon 58, Cal.

NEW YORK
75 S. Orange Ave., South Orange, N. J.

ROCHESTER 12
P. O. Box 24, Charlotte Station

HYT Size Gage, 10" model

Available accessories:
18" transfer gage
3" and 6" riser blocks



Your surface plate needs this **NEW** dimensional gage, the **VAN KEUREN HYT SIZE GAGE**

Here's why:

- it embodies the well-known *Van Keuren precision.*
- it has a decided price advantage.
- permits amazing speed in setting all dimensions (a matter of a few seconds!)
- it's accurate to .000050" over entire range.
- has exclusive design features: a patented spring-loaded non-rotating spindle eliminates backlash . . . measuring surfaces are accessible from front and back . . . it can be used in a horizontal position.
- it's ruggedly built for long life.
- easily portable . . . can be used anywhere in shop.

Now you can more quickly inspect drill jigs, lathe fixtures, gears, cams, splines, profiles, contours . . . and check many shop operations. You can easily set precision depths on drill presses, milling machines, jig borers, etc.

Write today for descriptive bulletin

VK

THE *Van Keuren* CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

seek the guidance of experienced explosive handlers before exposing himself to unnecessary hazards.

R A Cooley, *exec vice pres*
Propellex Chemical Div
Chromalloy Corp
Edwardsville, Ill

North American Aviation, Inc, at Columbus, Ohio, confirms that the sentence in question accurately states its position with regard to RDX.

In actual practice however, T B Tedlie of Manufacturing and Development states that employees at North American use normal care in the application of RDX for explosive forming. They do not crush it or otherwise abuse it.

Nevertheless, North American says that DuPont demonstrations and films show the rough treatment that can be taken by Cyclonite, Primacord, and other RDX explosives, and the company has been sold on the idea that RDX is considerably safer than dynamite and other explosives "that detonate merely by thinking about them."

Presented last year

Dear Sirs:
In your article about tantalum production and fabrication techniques (*AM*—June 1 '59, p109), the table at top of right-hand column on page 111 has this footnote:

"Fabrication of Refractory Metals, "by WL Bruckart, presented to American Society of Tool Engineers, Los Angeles, Calif, Oct 3, 1959.

Is this paper to be presented in October, 1959, or is the date in error?

J D Keller, Sr
Orlando, Fla

We're sorry about the error. The paper was presented on October 3, 1958—Ed.

"Every night, either tinkering with some fool invention or your nose stuck in the paper. I'm sick of it . . . Do you hear me?"

CALENDAR

Pressed Metal Institute—National Meeting, Sept 13-17, Stanley Hotel, Estes Park, Colo.

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting and Display, Sept 14-17, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 15-17, Edgewater Beach Hotel, Chicago, Ill.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 21-25, Int'l Amphitheater, Chicago, Ill.

American Welding Society—National Fall Meeting, Sept 28-Oct 1, Sheraton-Cadillac Hotel, Detroit, Mich.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 5-10, Ambassador Hotel, Los Angeles, Calif.

American Society of Tool Engineers — Semi-annual Meeting, Oct 8-10, Chase-Park Plaza Hotel, St Louis, Mo.

American Society for Testing Materials—Pacific Area National Meeting, Oct 11-16, Sheraton Palace Hotel, San Francisco, Calif.

Magnesium Association—Annual Convention, Oct 19-20, Hotel Roosevelt, New York, NY.

American Institute of Electrical Engineers—Machine Tool Conference, Oct 19-21, Hotel Cleveland, Cleveland, Ohio.

American Machine Tool Distributors Association — Annual Meeting, Oct 25-27, Statler Hotel, St Louis, Mo.

American Gear Manufacturers Association — Semi-Annual Meeting, Oct 25-28, Edgewater Beach Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Nov 2-6, International Amphitheater, Chicago, Ill.

National Tool & Die Manufacturers Association — Annual Convention, Nov 4-8, Statler-Hilton Hotel, New York, NY.

Now...B & S Offers 20% Savings on 80% of End Mill Applications!

Thriftmill
Brings "Throw Away" Tool Concept to End Mill Operations!

Why is the initial price of the NEW B & S Thriftmill 15 to 20% less than conventional end mills at a time when most other metal-working costs are rising?

This is a new exclusive design, a product of B & S progressive engineering and manufacturing techniques. The Thriftmill can be produced faster, more efficiently and therefore costs less.

Demand for the new Thriftmill is so phenomenal—large volume production lowers manufacturing and distribution costs.

Shop tested on profiling, slotting, peripheral milling and many other general end milling operations, the Thriftmill excels in over 80% of production applications. The new Thriftmill may mean new end milling economy and efficiency for you.

Ask your Distributor about the New B & S Thriftmill today! Send for new CONDENSALOG—easy to use specifications and prices on over 3300 "standard" cutters and end mills to: *Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.*

FOR THAT EXTRA EDGE IN PRODUCTION

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

B·S

PROGRESS IN PRECISION FOR OVER 125 YEARS

INDUSTRIAL DISTRIBUTOR
THE RIGHT HAND OF PRODUCTION

CIRCLE 231 READER SERVICE CARD

the shortest distance between

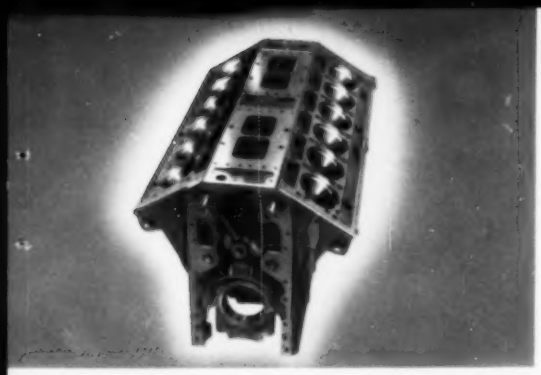
these two points . .

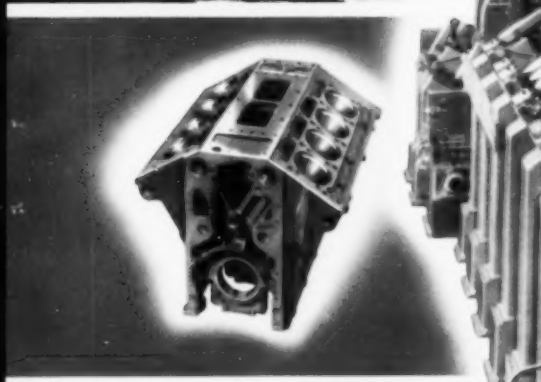
***Carpenter* stainless steel**

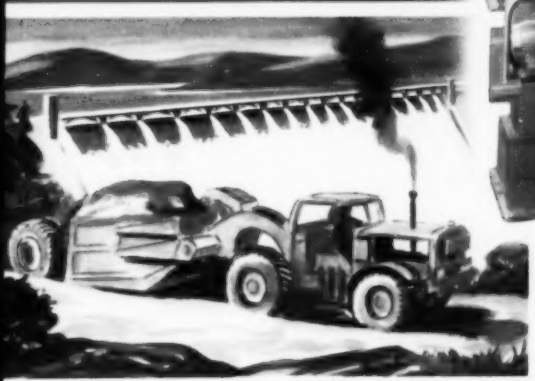
Machining operations are one of the major areas available to the manufacturer of stainless parts where economies can be realized without loss of quality. To help you take advantage of these economies through faster speeds, longer tool life and better surfaces, Carpenter has developed stainless steel grades that surpass any others in machinability. A large claim, indeed! . . . But one that's easily checked. Specify Carpenter on your next stainless order. The Carpenter Steel Company, 109 W. Bern Street, Reading, Pa.

***Carpenter* steel**

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

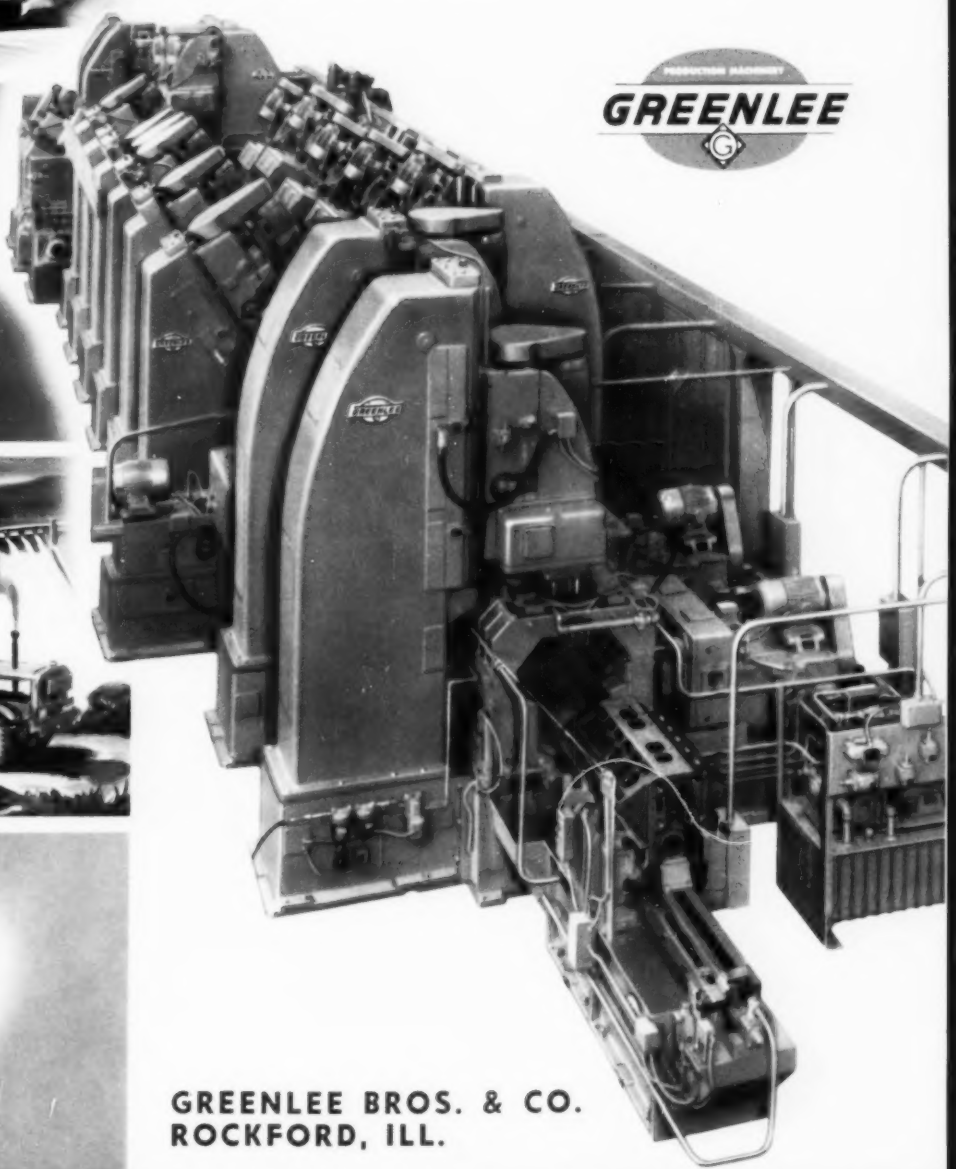






V-type Diesel engine blocks
in three different sizes
now processed on the same

GREENLEE
TRANSFER
MACHINES

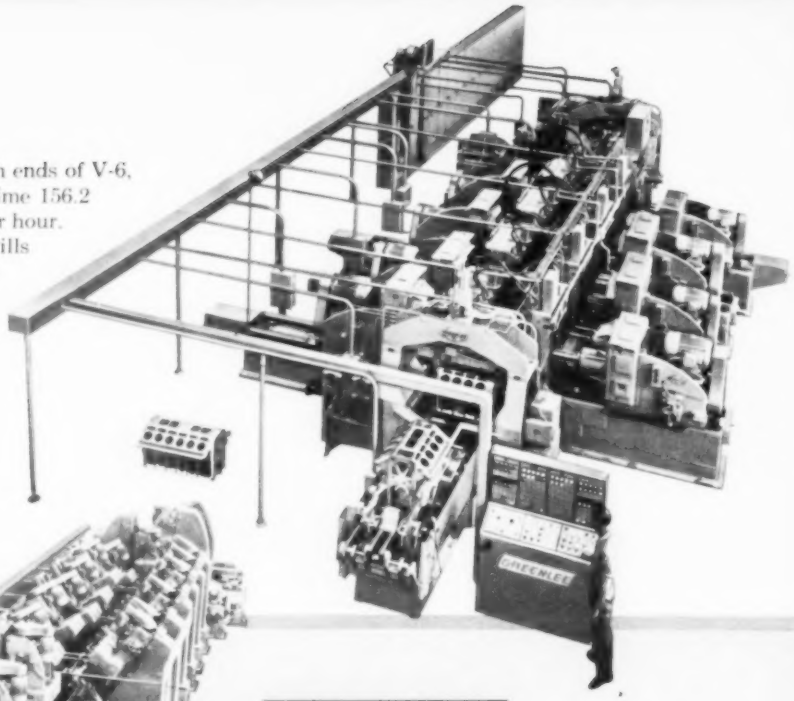


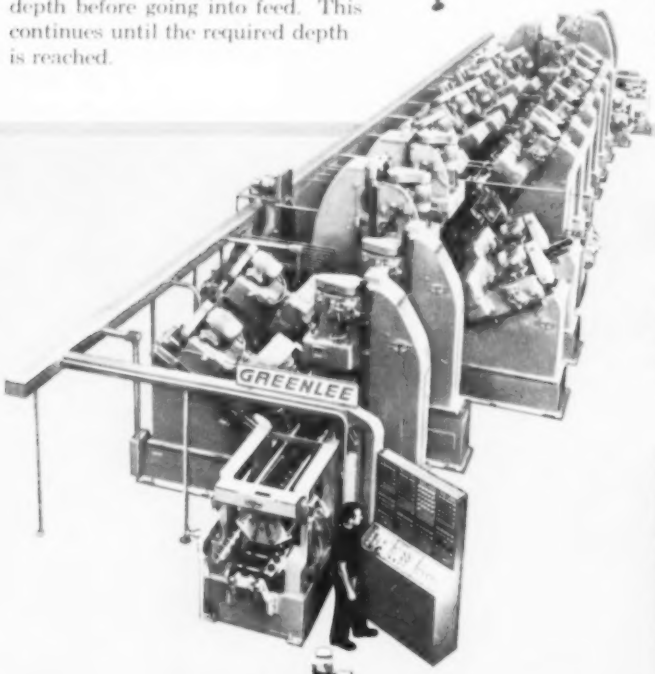
GREENLEE

GREENLEE BROS. & CO.
ROCKFORD, ILL.

MACHINE NO. 1

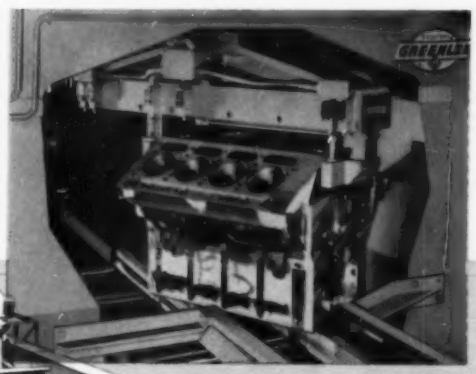
9 stations. 42 feet long. Machines both ends of V-6, V-8 and V-12 cylinder blocks. Cycle time 156.2 seconds. Gross production 23 pieces per hour. Rough bores cam and crank holes. Drills 3 oil galley holes 11 to 18 inches deep. Drills holes for tapping operations. Block is turned 90° in the second station. Heads for deep hole drilling have step feed (jumping jack) action, that is, the drills are fed to a certain depth and then retracted to remove chips. Successive passes rapid-approach to the last drilled depth before going into feed. This continues until the required depth is reached.





MACHINE NO. 2

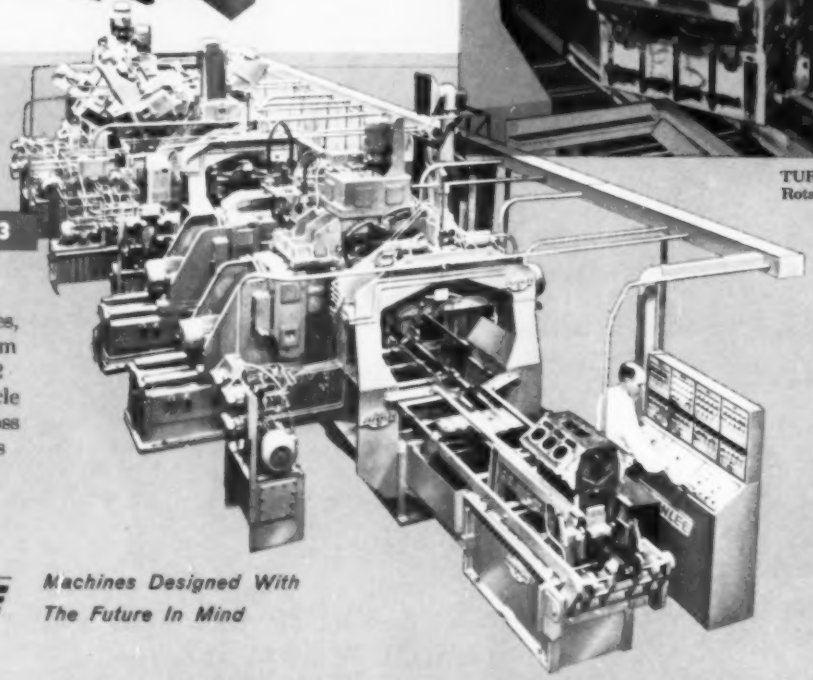
16 stations. 104 feet long. Machines top, bottom, sides and banks of V-6, V-8 and V-12 cylinder blocks. Cycle time 144 seconds. Gross production 25 pieces per hour.



TURN STATION
Rotates Block 90°

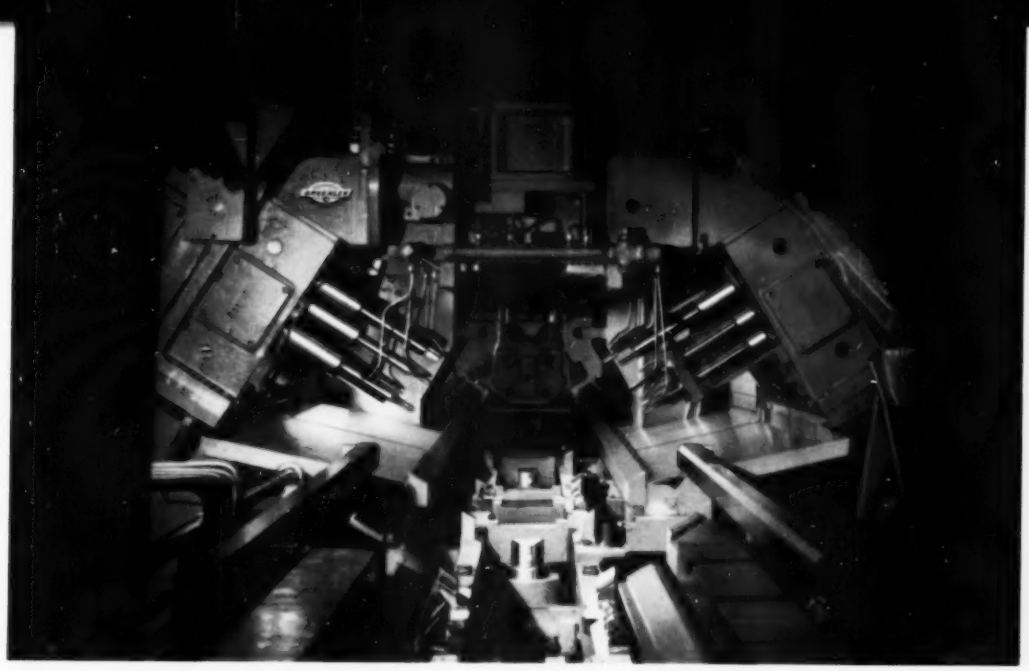
MACHINE NO. 3

11 stations. 64 feet long. Taps ends, sides, banks, top and bottom of V-6, V-8 and V-12 cylinder blocks. Cycle time 35 seconds. Gross production 104 pieces per hour.



GREENLEE

Machines Designed With The Future In Mind



Planned for quick, easy changeovers

A leading manufacturer of diesel engines now includes V-type models in its newly expanded line. In the early stages of planning for production, Greenlee representatives were called in. The problem was not a simple one. Although production rates would not be high — all three cylinder blocks for V-6, V-8 and V-12 engines would have to be processed on the same machines. Changeover time from processing one size block to another must be held to a minimum.

COOPERATION IN DESIGN

To help attain the necessary flexibility, the customer's engineers did an exceptionally good job of designing the blocks for interchangeable processing. Each cylinder, for example, has its own pattern of holes and bearings to permit easy changeover. Components were standardized wherever possible. Greenlee engineers working in close cooperation were able to take full advantage of this flexibility in design to provide further flexibility in machining. Lower initial cost and greater production economies resulted.

MACHINE CHANGES SIZE

When processing the ends of blocks in each of three sizes, the fixture frame and machining heads must be moved to accommodate increased or decreased length of block. A lever pulls the locating pin at each station. When all pins are pulled a push button is pressed and the adjustable part of the machine, together with the transfer bar on that side, moves to its new position. Locating pins accurately position the fixture side frame in its new location.

DOWEL SELECTION

The selection of the proper locating dowel in each station for each size block is controlled by a series of levers. The machines are automatically controlled to operate only when all the levers are set for the same size block.

TOOL CHARTS

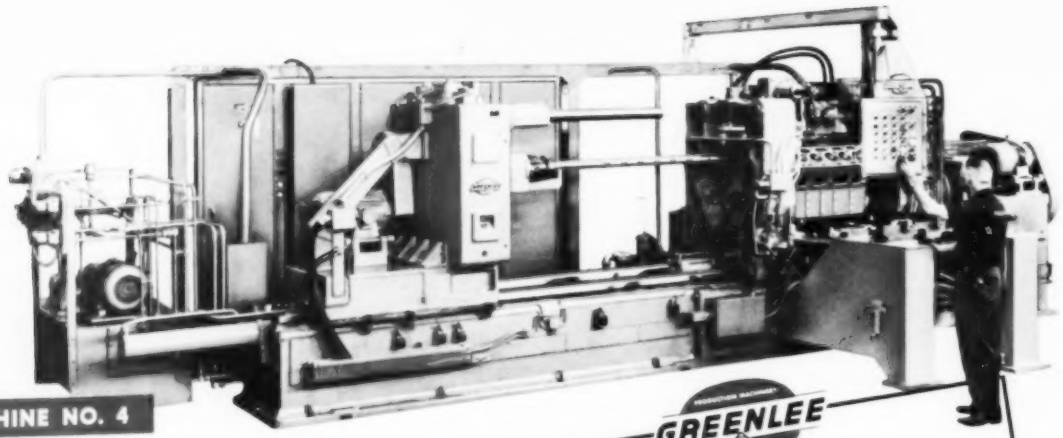
The correct tools and set-up for each size block are readily determined by following the tool charts and changeover check lists supplied with the machines. These charts help reduce changeover time and minimize the possibility of error.

FLEXIBILITY OF OPERATION

These machines were designed to process both cast iron and aluminum blocks. The ease with which they can be changed over from cast iron to aluminum machining demonstrates their extreme flexibility. Variable feed rates and ease of tool change make it possible to change from machining cast iron to machining aluminum in a minimum of down time.

HANDLING

A walking-beam type transfer mechanism is used to carry the blocks from station to station. The blocks are *carried*, not *skidded* through all five machines. Machine No. 1 has two turn stations, rotating 90°. Machine No. 2 has one 180° turnover station. Machine No. 3 has two turn stations rotating 90°, and one 180° turnover station. These 90° rotating stations are designed to handle the three different sizes of blocks without adjustment. The 180° turnover stations are manually adjusted in seconds to accommodate any of the three block sizes.



MACHINE NO. 4

Two-way horizontal machine automatically semi-finish bores cam holes, and finish cross-faces rear thrust bearing. Cycle time 103 seconds. Gross production 35 pieces per hour.

The sequence of operations automatically performed on this machine is as follows:

(1) Block is conveyed to machining position.

(2) Block is positioned to receive boring bar.

(3) Boring bar is advanced.

(4) Block is located for the boring cut.

(5) Boring bar is rotated and fed on the return stroke. This results in a pulling action keeping the bar in tension and eliminating vibration.

(6) After boring operation is completed, bar is positioned radially, block is positioned and bar is withdrawn.

(7) Block is removed from machine.

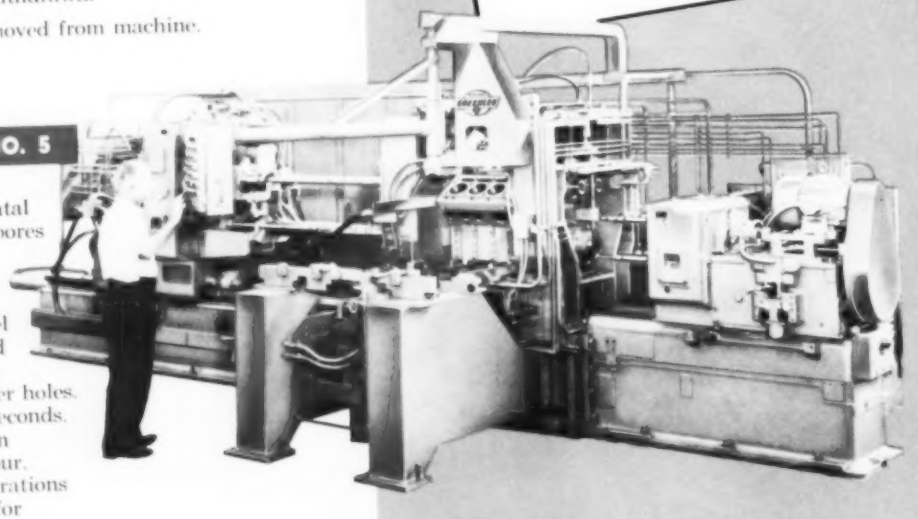
GREENLEE

FACILITIES and EXPERIENCE

(1) Greenlee plant facilities are large enough to erect a complete line and conduct test runs with coolant supplied from a central system built into the assembly floor.

(2) Greenlee controls every step in the manufacture of the machines which it produces. Engineering, foundries, machine shops, assembly floors are all centralized in Rockford.

(3) Greenlee has the experience and proven ability to build successful transfer machines . . . is considered one of the pioneers in the field of mechanized production.



MACHINE NO. 5

Two-way horizontal machine finish bores cam holes. Finish bores crank bore. Reams two dowel holes in each end of block. Finish counterbores idler holes. Cycle time 131 seconds. Gross production 27 pieces per hour. Sequence of operations is the same as for Machine No. 4.

GREENLEE
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ROCKFORD, ILLINOIS

Printed in U.S.A.

SPOT NEWS...

- **China National Machinery Import Corp, Shanghai branch,** is seeking to set up dealers in Mexico to sell machine tools, electric equipment, cutting tools, hand tools and a variety of mill supplies. This may be the beginning of a political and trade drive in Latin America. Low prices and good credit terms are reported being offered. For detailed story, see p79.

- **Number of different aluminum engine designs** are reported under way at General Motors. Some are being developed at GM Research (but others are in the prototype stage. Engines will use aluminum for both heads and blocks and for overhead valves, with displacement under 300 cu in. All the experimental engines are smaller than current V-8s.

- **Cross Co is first U S builder of transfer machines** to put a plant in Western Europe, where it will build complete machines and building-block units both for use there and for possible shipment back to its Detroit plant. The company is also setting up a subsidiary, Cross-Malaker Laboratories, in Mountainside, N J, to combine nuclear and electronic science as team-mates in the development of new automatic manufacturing technology.

- **Cincinnati Milling will come out with 35 electrical discharge machines** in September—all but two of them built on the building-block principle—and several other companies are readying new developments (see p2).

- **Big Three production of compact cars** is expected to give a big boost to chemical milling because Detroit for the first time will be concentrating on weight reduction and load distribution. Chemical milling (1) removes metal in applications not practicable by conventional milling methods, and (2) now can be applied to aluminum, which will come into increased usage as weight becomes an important factor in automaking.

- **Air Force shortly will announce successful extrusion of bare beryllium** in 20-foot lengths that meet aircraft quality standards. Northrop Corp's Norair Division, manager of the Air Force's beryllium extrusion development program, says "Within two years we hope to achieve aircraft quality beryllium extrusions in popular sizes and shapes on a production basis." The job will be done, if possible, on conventional extrusion equipment without use of "canned" or "fixed billet" techniques.

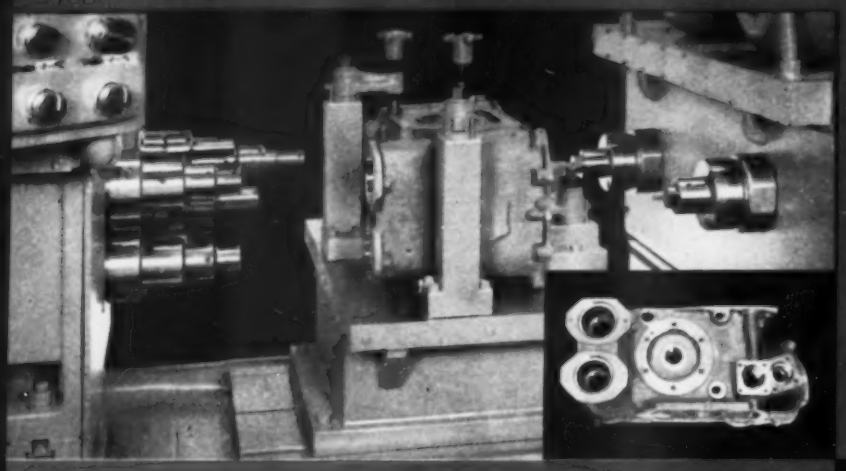
- **Hertz Corp (car rentals) will buy 4500 Big Three small cars sight unseen** at a cost of more than $10 million because it has "complete confidence in the engineering and design abilities of American auto manufacturers."

- **Republic Steel is now producing strip steel from iron ore without melting** at its new Research Center. Process uses iron powder, bypasses such conventional operations as coke ovens, blast furnaces, hearths, blooming mills. Process, however, is still "a long way from commercial production."

- **While Russia is greatly increasing its industrial production** (up 11% last year alone), a top Soviet official claims output will soon bog down because machine tools are being produced in too small a quantity to keep up with demand. Even the Soviet goal of 1.5 times present machine tool output by 1965 will be insufficient to meet the USSR's needs, he says.

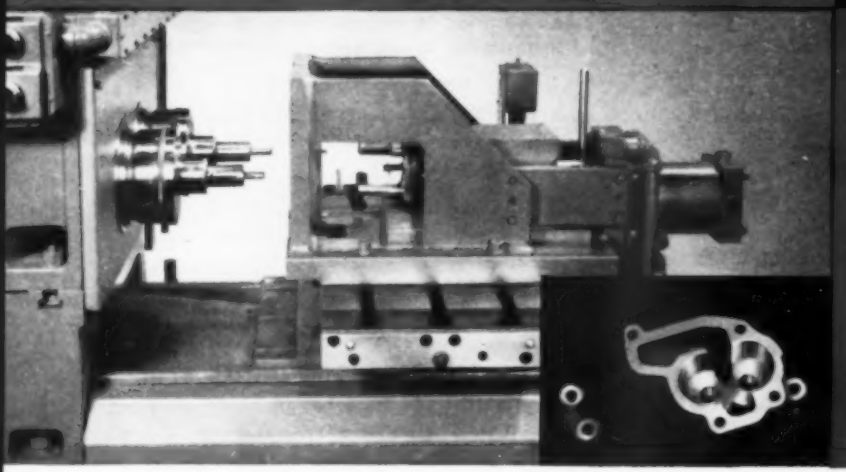
- **One big roadblock in the way of revising the Treasury Dept's Bulletin F** is what to do about taxation gains from sale of depreciated property. One solution: make returns from sale of such property ordinary income taxable at income tax rates. This would overcome Treasury's reluctance to liberalize useful life schedules in Bulletin F on grounds that such liberalization would lead to a greater use of the capital gains device.

Standard Ex-Cell-O Precision Boring Machines



. . . FOR FASTER MULTIPLE-HOLE WORK

Standard style 17-A performs 26 operations in one cycle on a magnesium aircraft casting. Machine bores five bronze bushings, counterbores seven diameters, faces four surfaces and chamfers eight shoulders with five spindles at left, two spindles at right.



. . . FOR FASTER CLOSE-TOLERANCE WORK

Style 112-D finish-bores gear pockets and shaft holes, and plunge-faces pocket bottoms of oil pump bodies to tolerance of plus or minus .0005". Flat faces are square to the bores and parallel to each other within working limits of .001".

59-17

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CIRCLE 237 READER SERVICE CARD

WASHINGTON...

Depreciation—no decision...

That longtime target of U S businessmen and industrialists, government tax depreciation policy, is again under fire in Washington—but there's little likelihood that anything definite will be done about what industry calls "outmoded" laws in the near future.

For one thing, industry representatives testified in mid-July before the Senate Small Business Committee, which has no authority to consider specific legislation, and there are bills in the Congressional hopper.

Defense contractors are complaining about their inability to replace outdated production equipment, blame "unrealistic" depreciation rates as laid down by the controversial Bulletin F. Said Florida's Senator Smathers, chairman of a subcommittee on Government Procurement, "Rising replacement costs and technological changes make useful life depreciation a questionable system for a national economy which must grow rapidly."

Nevada Senator Bible, chairman of the Small Business Subcommittee on Taxation, claims that small firms are hardest hit by the Treasury Dept's "adherence to useful life depreciation" because they "have no ready access to capital in the securities market."

Hopeful words, coming as they do from Senators, but the Small Business Committee can listen to reams of testimony and publicize the problem—only it can't approve legislation and bring it up to the Senate for a law-changing vote.

Foreign competition...

Representatives of the metalworking industry are urging Congress to do something about stepped-up competition from foreign manufacturers.

In a mid-July hearing before a Senate Banking Subcommittee, Charles W Stewart, president of Machinery & Allied Products Institute, charged that lack of an overall U S trade policy is leading to loss markets here and abroad—and it's resulting increasingly in flights of investment capital abroad.

In essence it's a question of whether the U S is pricing itself right out of world markets and what can be done about it. Heading the investigation is Wisconsin Democrat Senator William Proxmire, who claims machine tool and tractor manufacturers in his state are opening plants in Europe to take advantage of low labor rates.

Another witness, Ralph Cross of Detroit's Cross Co, manufacturers of transfer equipment and machine tools, told the Subcommittee that his firm, which employs about 400 people, is establishing a plant in Europe as the only way to meet foreign competition in the Midwest.

Said he, "We have a choice of drastically reducing our business here and running the risk of eventually going out of business or erecting a plant in Europe and redeveloping our worldwide business from over there . . . and we have no intention of going out of business."

Both Cross and Stewart are critical of high U S wages and featherbedding, which they say are giving foreign companies a strong lever to increase exports to U S and world markets.

Stewart added, "The flight of capital goods investment abroad has been more dramatic and has been concentrated in a shorter space of time than general figures indicate . . . The U S export position is deteriorating."

One reason for this, both Cross and Stewart contend, is that the U S has "the most backward depreciation laws" of any industrial nation.

Suggested remedies: (1) greater tax and depreciation allowances, (2) better credit facilities for international trading, (3) stronger international patent protection, and (4) an easing of antitrust statutes where foreign trade is concerned.

But on the other hand, Charles P Taft, general counsel for the Committee for a National Trade Policy, said "There is little sound evidence that the U S is either pricing itself out of world markets or that increasing productivity abroad is resulting in contraction of trade. Rather, he said, trade is expanding, and he urged the Senators not to upset the present U S free trade applecart.

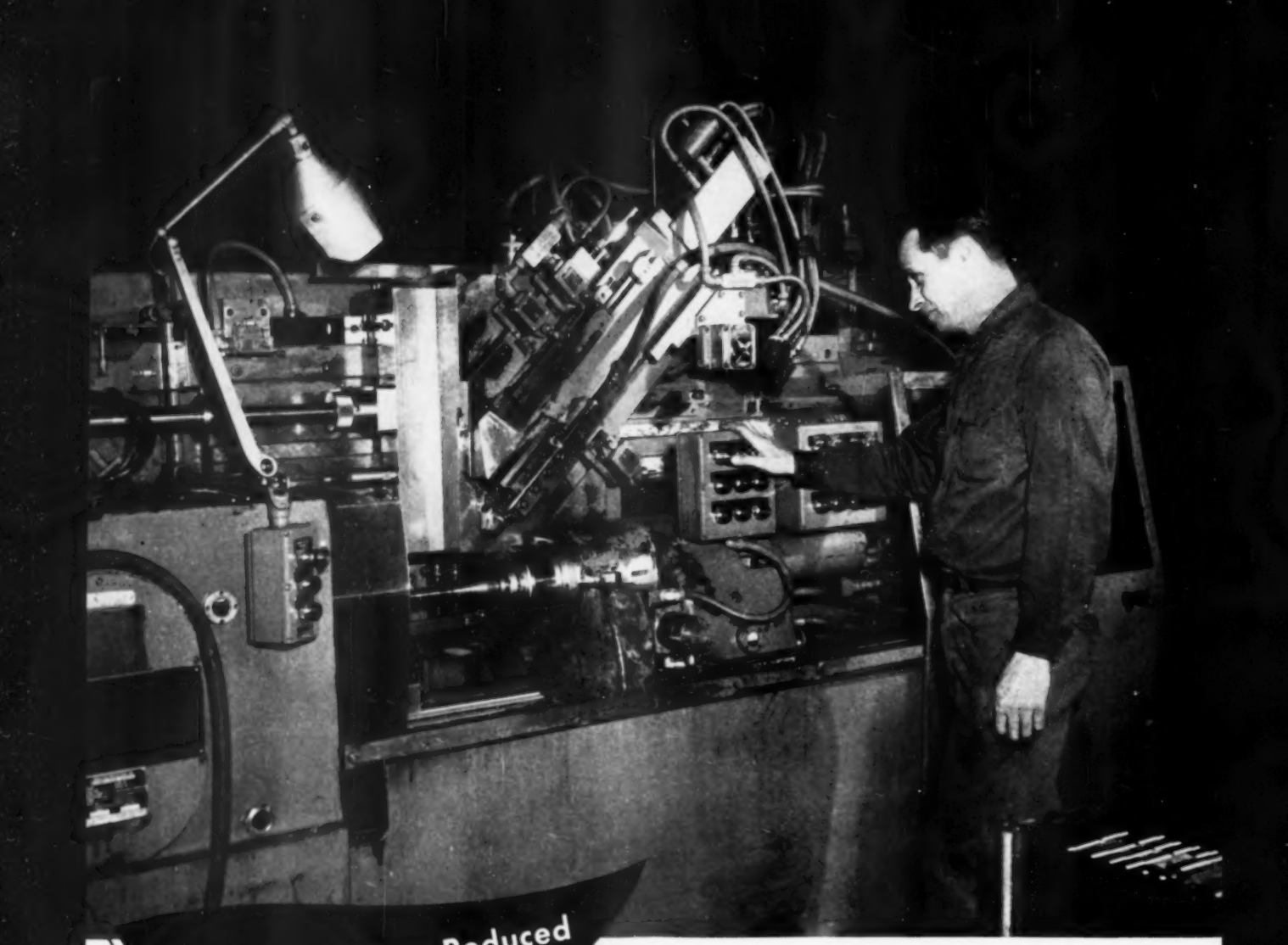
Curbing retired "brass"...

Tougher restrictions are being urged to keep retired Army, Navy and Air Force officers from "selling" to their former Services as representatives of industry. Present regulations ban such activities for two years after retirement.

But now extreme proposals before Congress call for banning retired brass for life industry contact with projects for which the officers were directly responsible during active service. And it has been recommended that no defense contracts be awarded to firms with retired senior officers on the payroll.

That's the extreme. The outlook is for a milder change in the law, if any. First off, the term "selling" must be defined.

One proposal: bar retired officers for two years from specific procurement or development projects with which they were Service-connected.



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DETROIT...

Steel no problem...

The steel industry shutdown poses no immediate threat to automakers. Every company has a heavy inventory, enough to close out 1959 model production on schedule and adequately stock dealers with the new offerings.

"We have enough steel stockpiled," a Chrysler spokesman said, "to take us into December production and possibly January." The company shut down its Imperial line in early July for model changeover, and its other makes followed suit three weeks later.

General Motors, at its uninformative best, acknowledges taking "the necessary steps to protect its interests and those of its dealers and public." GM's stockpile, in other words, should carry it through to mid-August shutdowns, as well as fill dealer pipelines. The same holds true of Ford, whose divisions will shut down between August 11 and 16. Ford's own steel production (accounting normally for 50% of its requirements) remains unaffected.

Only problem worrying automakers at the moment is stoppages occurring at small parts suppliers who lacked the capital for stockpiling. It is a matter of logistics. The customer in these instances would gladly lend steel or provide a premium for warehouse purchases, but the question is when and where?

Small cars almost here...

The Corvair, Falcon, and Valiant are now four-wheeled facts, buzzing around the proving grounds of at least the first two makers in considerable quantity. Ford even has a Canadian version of its Falcon, to be called the Frontenac.

Chevrolet started pilot production of the Corvair right on its originally forecast July 15 schedule. Aluminum for the basic engine castings flows in on molt contract from Reynold's new Massena (NY) reduction plant to the adjacent Chevrolet foundry. Engines are assembled in Buffalo and thence shipped to Willow Run, Mich, for installation in the car. Bodies-in-white are provided by Fisher from a brand new Willow Run facility.

Final assembly takes place a conveyor's distance away in what used to be Chevrolet's heavy-duty truck plant. By early August, the first Corvairs should be on their way to dealers. Meanwhile, unemployed auto workers are camping out at Willow Run in hopes of a chance at jobs not taken by high-seniority employees.

Ford, aiming at volume Falcon production by early September, is currently producing a few prototypes each week from its Allen Park, Mich, quality control center. This is a miniature but complete factory for checking the fit of parts made from production dies and also for training assembly plant supervisors.

Chrysler has a late August pilot production target for its Valiant. It will be assembled on lines adjacent to Dodges and Darts in Hamtramck. Engines, stampings and bodies-in-white will come from nearby Chrysler Corp plants.

All three makers plan somewhat later expansion of assembly operations in key facilities in other parts of the country. Each make will have a Canadian equivalent, and all hope ultimately to exploit export potentials by shipping knocked-down units to existing assembly plants overseas.

Meanwhile press and advertising agents are in the middle of a weird battle over engine location. Chevrolet hired retired consultant Maurice Olley, famous for developing the almost universally accepted s/a-type suspension, to lecture the press on the virtues of rear positioning.

Within hours a Ford man with an elephant's memory dug up a 1953 SAE speech of Olley's that could hardly be considered complimentary to rear-engined cars. On the fringes, Simca attacked Volkswagen and Renault, with George Romney chiming in for good measure.

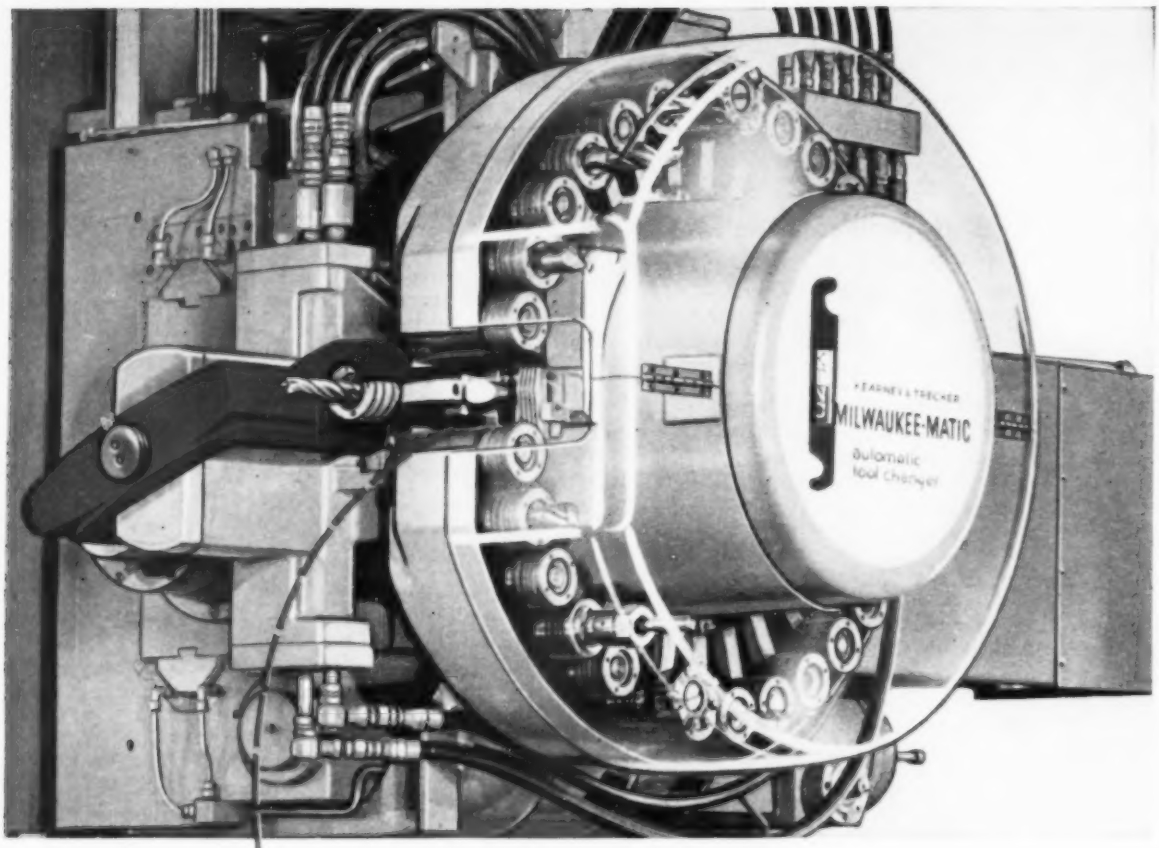
Olley plugged Corvair's "clean slate" approach to design versus the shrinking of orthodox models by competition. He claimed that the Corvair will handle and ride better, be safer and quieter than any of its forthcoming competition.

But his 1953 pronouncements rose to haunt him. ". . . It has always appeared to me," he said then, "that rear-engined cars are a poor bargain at least in the form in which they are presently built . . . the forward fuel tank is a collision risk, as is the mass of engine in the rear. The cars are noisy . . . impossible to handle in a wind."

Olley can be defended on that last point—the Corvair is literally dependent on special long-cord (30-degree cord angle) low-profile tires mounted on unusually wide rims. Such tires were not in existence in 1953.

But enough of that. The small car picture as a whole looks rosy enough to prompt predictions of 1960 being a 6.8-million car year, including imports. The three newcomers confidently expect to contribute at least 900,000 units to this total.

◀ CIRCLE 238 READER SERVICE CARD



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AIRCRAFT and MISSILES...

TRENDS

Aircraft vs electronic makers...

The Pentagon has put together the most comprehensive listing ever made of companies with contracts for missiles. It has been sent to the Labor Dept—under wraps—for use in labor's deliberations over the aircraft industry's long-standing petition that electronics firms in missile work be required to pay the same Walsh-Healey Act minimum wage as aircraft builders.

Neither defense nor labor officials will comment on the report's conclusions, except to say the report covers contracts in fiscal years 1958 and 1959 and breaks down awards for missile end-items, electronic subsystems, and other components by industry, company, and dollar volume.

The bureaucrats' reluctance to discuss the report is easy to understand. Washington considers the aircraft-electronics-missile case the most significant one ever to come up under the Walsh-Healey Act—certainly, the hottest politically.

The law specifies minimum wages to be paid on government contracts. At issue in the missile case is this: whether the government will require the traditionally higher aircraft industry wage level for missile—and presumably all space—projects, thus wiping out the electronic industry's current wage advantage of roughly 20%.

The Labor Dept must decide whether to expand the aircraft industry's Walsh-Healey definition to include missiles and "completed end-product electronic systems" (as the aircraft makers and their two principal unions propose); whether to set up a new and separate missile classification or include missiles with electronics (as the electronics industry prefers); or whether to make a compromise—lumping missile end-items under the aircraft industry but excluding electronic missile subsystems.

Some months back, labor came up with the third choice as a proposed definition change with which to start the case out. As the case shapes up now, the outlook is for a new Walsh-Healey aircraft industry definition to incorporate some version of this proposal.

The definition question is the basis for the minimum wage determiantion which comes much later. Labor makes a wage survey of workers in the industry as defined, sets pay-rate floors on the basis of its findings of a prevailing minimum wage. The new missile contract report drawn up by the Pentagon will provide the basis.

Red tape cut in allocations...

Defense subcontractors will be exempted from the red tape and elaborate bookkeeping now provided in the "Defense Materials System." This is the government's standby metals allocation scheme which would be expanded in case of war.

As the plan works out now, prime and major military subcontractors must go through the motions using government priority ratings to buy steel, copper, aluminum, and nickel-bearing alloys. DMS carries its weight, though, for priorities to buy scarce electronic and other components.

Cuts in boron-based fuels...

Faster military deemphasis on air-breathing engines to power future aerial weapons than was expected has forced the Pentagon to consider closing one of the government's two big boron-base fuel plants. Both are starting production this month—one run by Olin Mathieson at Niagara Falls; the other by Callery Chemical Co at Muskogee, Okla.

These are the so-called "exotic" high-energy fuels that will presumably be used in the GE J-93 engine afterburner.

AIA's "shopping list"...

Just completed by Aerospace Industries Association is a list of scientific achievements the U S and its allies must rack up over the next 10 years if we're to stay ahead of Russia and her allies in the race for space.

On the manufacturing shopping list:

- Widespread adaptation of automation and numerical control.
- Closer tolerances.
- Brazing, welding and heat-treating in carefully controlled atmospheres.
- Use of ceramic adhesives and bonding of very large contoured parts and even entire wing and fin assemblies.
- Shape-fabrication of high-strength steels with yields in excess of 300,000 psi, and titanium alloys with strength yields of 200,000 psi and up.
- Machining operations with materials and/or tools either superheated or at subzero temperatures.
- Emphasis on ultrasonic machining and electrical discharge machining.

And, AIA's researchers claim, space age products will have to be so precise that the chance for human error must be eliminated. This can be done by recording extremely complex testing procedures on tape. Needed, too, the AIA people say will be memory drums and storage devices that can evaluate test data and actually make decisions.

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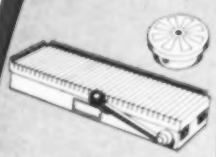

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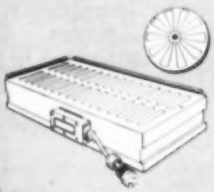

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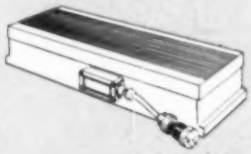

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MACHINE TOOLS... TRENDS

Biggest volume in 27 months . . .

Net new orders for cutting type machine tools jumped $14 million in June to a total of $52 million for the month. It was the biggest month's bookings in 27 months.

Orders for forming type machines were at $11 million in June, pushing sales of both cutting and forming types up to $63 million.

Shipments of cutting type machines rose to almost $35 million, while forming type machines reached $12 million.

During the first half of 1959 cutting type machine builders secured net new orders amounting to $234 million. That represents a gain of 67% over bookings of $140 million in the same period last year.

Potential machine tool business is bigger than in a long time. Automotive buying the latter part of this year—for aluminum engines, new transmissions—will be sizable. New stamping plants also are being planned. Special machinery builders report inquiries from the appliance and aircraft industries as well as from auto makers.

Cross to build in Germany . . .

Migration of machine tool builders to western Europe is still on. Latest recruit is the Cross Co, which is now erecting a new plant in Germany to make transfer machines and also building block units. These units are likely to be shipped back to the Detroit plant for assembly as well as being used in European-assembled machines.

Two other U S machine tool builders are deep into negotiations for European connections.

Poland orders U S machines . . .

Zeran automobile plant in Warsaw is reported to have received its first U S machine tools—five Gleasons paid for from the credit extended to Poland by Washington. The machines will be used to make the hypoid rear axle.

Zeran hopes to buy presses, dies, gear grinders, honing machines and other equipment in the West, with the United States, Britain and West Germany as likely suppliers.

The Zeran plant is said to be tooled largely with Russian machines supplied on credit some years ago, but it is almost impossible now to get spare parts. New Soviet machines are reported unattainable. Reason is that the Russians are concentrating their exports on China and selected western countries. This move is being made either for political purposes or to earn hard currency.

Poland is attempting to expand its machine tool sales westward through Metalexport, the State trading agency. It is busy sending salesmen to win foreign friends and to add to its network of distributors.

Polish machines sold here . . .

Initial Polish machine tool sales in this country amounted to $50,000. A start also has been made in West Germany. Daimler-Benz placed a trial order for $15,000 of these machines.

Nine Polish machines have been on exhibit at the Chicago International Fair: an 18-in. engine lathe, a large turret lathe, a large radial drill, a thread roller, a small single-spindle Swiss-type screw machine, a large cold-saw for cutting off steel billets, two large knee-type millers, and a combination punch and shear for structural work.

Five of the Polish machines have been sold to a Chicago firm which will use them for production in its shop and also for exhibiting what Polish tools can do. This firm is to act as distributor in the Middle West for Polish tools. Metalexport is reported negotiating with a New York distributor to become selling agents on the Atlantic and Pacific coasts.

Also on display at Chicago Fair: a Mexican-built bench type drill press, a West German engine lathe and surface grinder, an Austrian bench-type engine lathe, and a Japanese thread rolling machine.

China to sell tools in Mexico . . .

Mexican machine tool import agents have received letters from the China National Machinery Import Corp, Shanghai, offering for sale in Mexico a variety of Chinese-built machine tools, cutting tools, hand tools, grinding wheels, welding machines, pumps and compressors.

The letter invites specific inquiries against which the Chinese say that they will "be glad to forward our most competitive quotations." Li Yuan Cheh, manager of the Chinese company, has sent to the Mexicans a number of catalogs of various products for export, printed in English.

This is believed to be the first time that the Chinese have tried to penetrate Latin America with any product. The Czechs and the Russians have lately been soliciting machine tool orders in Mexico.

BF.

What's the lowest cost way to produce steel parts like these?

You may be paying considerably more than you need to for parts like these if you aren't taking advantage of Ryerson flame-cutting service.

Size makes no difference—nor intricacy of shape. You can order one part or one thousand and get quick delivery of steel cut to close tolerance—with almost die-cut accuracy from piece to piece. And here's where the saving comes in:

1. **No dies or molds** are needed so you save this cost when you switch from cast or forged parts to flame-cut parts.
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3. **Freight costs lower**—If you're now paying freight on steel you later scrap you may well be able to pay for flame cutting with the money you save by shipping lighter flame-cut parts. The blank for a 6" disc is 49% heavier than the disc itself. Storage and handling expenses are reduced, too.
4. **Less time in process**—You can often convert finished products into cash more quickly because parts can be produced faster by flame cutting.
5. **No loss on spoilage or rejects**—They're our problem—not yours.
6. **Design changes are simpler** and can be made more frequently without sacrificing manufacturing economy.

You draw on the nation's largest steel stocks at Ryerson—and unequalled flame-cutting facilities are ready to work for you. A blue print or sketch with clearly marked dimensions is all we need for prompt handling of your requirements. Call your nearby Ryerson plant for cost-cutting flame-cut steel today.

In stock: Carbon, alloy and stainless steel—bars, structurals, plates, sheets and strip, tubing, re-bars—industrial plastics, machinery & tools, etc.

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MATERIALS...

Coated powders...

New techniques for producing improved coated metal and ceramic powders are further enlarging the horizons of engineering materials. Coated powders offer advantages in electronic devices, thermal insulators, abrasives, solid propellants, and metal-powder parts. They offer another lightweight material for use at elevated temperatures under oxidizing conditions —for aircraft and missile construction.

Using a fluidized-bed vapor deposition process, a wide range of coated powders can be produced, according to Dr Jos H Oxley and Dr John M Blocher, Jr. of Battelle Memorial Institute, Columbus, Ohio. In this chemical process, a thin film is deposited upon particles in a chamber containing a vaporized coating material.

Lead-cemented alloys...

By mixing molten lead with finely divided solid particles of other metals or materials, a promising new class of metallic materials is developed. The lead-and-powder mixture combines the properties of both lead and the other material. In addition to nuclear shielding products, the potential properties of the mixtures suggest uses in bearings, gaskets, special magnets, etc.

Another development of Battelle Memorial Institute, novel methods were devised to make these unconventional alloys. When large amounts of powdered solids are added to molten lead, the mixture becomes thick and sluggish. A revolving crucible, resembling a cement mixer, was designed to mix the material. Because most metals resist being stirred into molten lead, special pretreatment of the powdered metal and special mixing techniques were devised. After hot mixtures are poured for quick hardening, molds are vibrated to minimize porosity.

At least six metals are particularly well suited for the new "alloys"—cobalt, copper, iron, molybdenum, nickel, and tungsten. Both the size and the shape of the metal-powder particles, as well as the quantity, affect the properties of the final material. Effort now is to develop compositions for special end uses.

Foamed sandwich...

A new sandwich structure called "Pelcor" uses a corrugated core formed of two very thin, high-strength facings separated and joined with a light-weight foamed adhesive or ceramic bonding material. Monogram Precision Industries, Inc. has exclusive rights to engineer, manufacture and market this sandwich structure.

Orvil S Tuttle, inventor of the Pelcor process, says that no difficult forming operations are involved, that the material can be worked in the full-hard condition, and that it is not necessary to heat treat the panel after assembly. Several West Coast aircraft companies are testing prototype panels. The material is said to be unique in that its two stiffened skins, or faces, behave structurally as a plate. In the major axis, the structure acts as a stiffened beam to carry flexural stresses and shear loads. As a column with stiffened faces, the sandwich will carry axial loads. Thus, it carries multi-directional loads better than most corrugated panels.

At about $25 per sq ft, this material is expected to cost less than 10% of the cost of a brazed stainless-steel honeycomb construction. Structures may be manufactured using stainless steel, moly steel, carbon steel, tinplate, titanium, aluminum, magnesium, fiberglas, etc.

A panel can be used for ducting air, liquids, wiring, hydraulic lines, etc. Similarly, it can be used for fuel or fluid storage. The corrugated structure permits the panels to act as heat exchangers, for either heating or cooling.

Eddy current tests tubing...

According to the Damascus Tube Co, Greenville, Pa, the widely used and accepted hydrostatic tests for tubing, required by ASTM specs, lack reliability. Pits and other flaws cannot always be detected by this method. Occasionally, tubing with defects approaching 90% of wall thickness has passed hydrostatic tests successfully.

Actually, the tests accelerate time-to-failure rate because the defective area is further strained by the pressure used to test it.

Convinced that eddy-current-testing methods used in other fields could be adapted to tubular products, Damascus tried a variety of radiographic testing equipment. Finally, this company installed the RADAC system manufactured by Metrol, Inc of Pasadena, Calif. Proved 100% reliable for production-run testing, nearly one million inspection feet of tubing have been tested and performance has been without error.

Holes, laps, seams, porous areas and other discontinuities, plus their boundaries, are located and defined by the distortion of the eddy-current pattern. When the equipment discovers a flaw, an alarm sounds, a red light goes on, the flaw location is automatically marked with red paint, and the location is shown on a chart which becomes a permanent record for the tube.

STANSCREW

Symbol of a new concept

in fastener service

American industry is learning Stanscrew means extra values.

This symbol personifies a trained staff of fastener specialists. Their technical assistance can often help you reduce fastener and assembly costs.

It means extra quick deliveries from complete inventories maintained at three conveniently located plants . . . over 5,000 different types and sizes to assure a broad selection for the great majority of your requirements . . . and, above all else, fasteners of consistently high quality.

Although it first appeared in 1958, the Stanscrew trademark represents a wealth of fastener experience. For it combines the technical skills and specialized facilities of three major manufacturing divisions of Standard Screw Company, each an honored name for more than 80 years. They are:

THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
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THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

For fasteners, specify Stanscrew. For other needs of home and industry, Standard Screw divisions also produce:

Moen single-handle faucets • *Hartford textile spindles*
Roosa Master fuel injection pumps • *Chicago tappets*

Each division also provides a complete design and manufacturing service for cold headed and screw machine products.

STANDARD SCREW COMPANY
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WHAT'S AHEAD... in Metalworking

TRENDS

Strike may force output down from new peak...

Metalworking operations have been at a new peacetime peak since the beginning of June, having inched above the previous record set in December, 1956. Every major area has participated in the upturn, with spectacular gains having been made in industrial and electrical machinery.

It is likely that production will temporarily slip back down as the steel strike lengthens. But any important slowdown will not be felt much before mid-August. Steel stocks in users' hands vary widely, but most consumers have enough tonnage to keep them going for 60 days or longer.

One of the biggest single factors in the overall rise of metalworking production is the boom in auto sales, even with new models coming soon. That, along with the continuing boom in all kinds of appliances and a steady rise in agricultural equipment production is keeping a firm floor under the consumer hard goods industries.

Shipbuilding, for several years in the deepest doldrums, is doing very well these days. Something like $280 million in new construction orders are slated for this industry in fiscal 1960. Most of this will come from ships to be built under government subsidy (the government pays nearly 50% of the cost of construction).

This new business is in addition to $800 million worth of work already in the yards.

To jump from the biggest to the smallest in marine building, outboard motor production is now running about 20% ahead of year-ago levels, and the entire pleasure boat and motor industry is expanding fast. Motorcycle manufacturers, too, report that sales are up over last year—about 10%—and a further slight pickup is expected.

Manufacturers of plumbing and heating equipment say that sales and production have been picking up steadily over the last few months and that June and July have been really good. The first quarter was slow, largely because the severe winter delayed many underground utility and sewer projects. For this reason, production up until June did not reach year-ago levels.

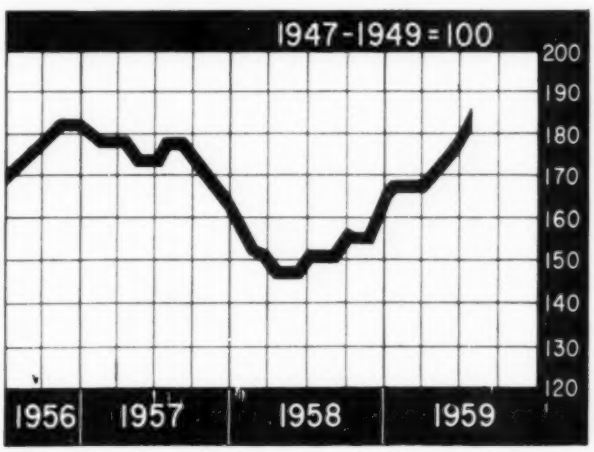
Getting over into metalworking's basic industrial processes—welding job shops are currently working 10-hour shifts and 55-hour weeks. Backlogs stand at nearly three months in most shops, with strong aircraft orders giving some shops a boost.

Sheet metal specialty shops are now doing much better than they did earlier this year, even though most of them haven't yet achieved the big backlogs of pre-recession days. Black iron business has picked up, as has manufacture of industrial guards.

Plating job shops report their business is currently about 25% ahead of last-year levels, and the last two months have really shown a big upturn. Much of the pickup is attributable to orders from the radio and television industries and from manufacturers of screw machine products. Several shops are working three shifts a day.

Stamping job shops have increased their business somewhere between 10% and 15% over the last eight months and profits are increasing along with volume. Says one stamper, "The market is still very competitive, but now there's enough business for everybody."

And the increase in stamping business, it seems, comes from a wide variety of industries.



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

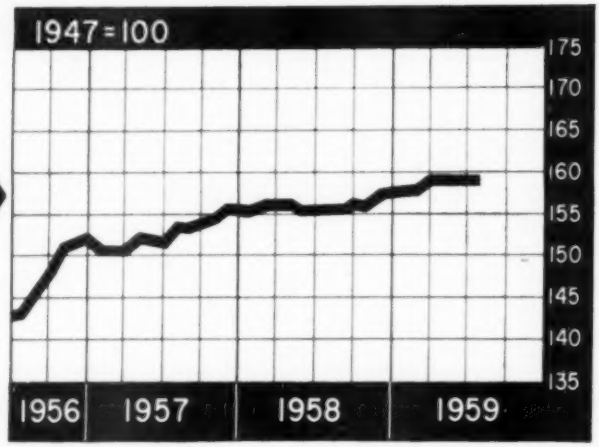
	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total Index	**185**	**183**	**178**	**151**
Machinery	154	149	125	
Electrical Machinery	218	208	171	
Autos	139	136	88	
Other Transportation	351	351	352	
Other Metalworking	158	155	132	

TRENDS

WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total Index	**158.8**	**158.7**	**158.7**	**155.9**
Metalworking Machinery	185.3	184.9	180.9	
Other Machinery exc. Electrical	169.7	169.6	166.1	
Electrical Machinery	160.0	160.4	158.9	
Fabricated Metal Products	148.8	148.8	146.3	



Another round of inflation?

The consumer price index for the latest month showed a slight increase. The Department of Labor reports the index at 124.2, a new record high. But that latest increase is not the signal for a new round of inflation, since many of the factors that put pressure on price levels are currently absent.

Cost push pressures, brought about in the past by wage increases that exceeded increases in productivity, have been responsible for much of the inflation since the end of the war. But wage increases granted this year have been modest, and productivity has jumped enough to permit business to absorb the higher wage rates without increasing prices.

The federal government may end the new fiscal year in the black, so a budgetary deficit won't be a major threat this year. Although the Democratic Congress came to Washington with a mandate from the people for bold action, the President's strong stand against inflation has blocked any program that might lead to another deficit. And the rapid recovery from the recession has eliminated the need for much of the spending envisioned when Congress convened.

The money supply isn't increasing, so borrowing will become more difficult. The Federal Reserve has increased the discount rate on loans to banks borrowing from the Reserve System, and this tighter credit policy is making itself felt. Businessmen and consumers will find buying on credit more costly, and will be reluctant to go on a spending binge that could push prices up.

Falling food prices in recent months have been the major factor in keeping the price level down. Because declining food prices have offset increases in prices of other consumer goods, the net effect has been a stable cost of living.

And further drops in farm prices will produce new declines in the cost of food. But the costs of key services, such as rent, have risen considerably in recent months.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	160.5	158.7	128.2
Steel ingot operation (thousands of tons)	N.A.	2,252	1,481
Electric power output (million Kilowatt hours)	13,502	13,124	11,851
Production of automobiles and trucks	161,331	139,829	96,855
Engineering construction awards (Eng. News-Record—millions)	446.5	578.4	733.0

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	155	153	132
Index of durable manufactures production (1947-1949=100)*	172	169	139
Durable goods manufacturers' sales, millions*	$15,449	$15,166	$11,643
Machinery manufacturers' sales, millions*	$ 4,468	$ 4,423	$ 3,736
Durable goods manufacturers' new orders, millions	$15,107	$15,796	$11,423
Machinery manufacturers' new orders, millions	$ 4,587	$ 4,632	$ 3,690
New Orders for Nonelectrical Machinery (1950=100)*	171	186	129
New Contracts for Industrial Construction (1950=100)*	114	127	87

* Seasonally adjusted
N. A. Not Available

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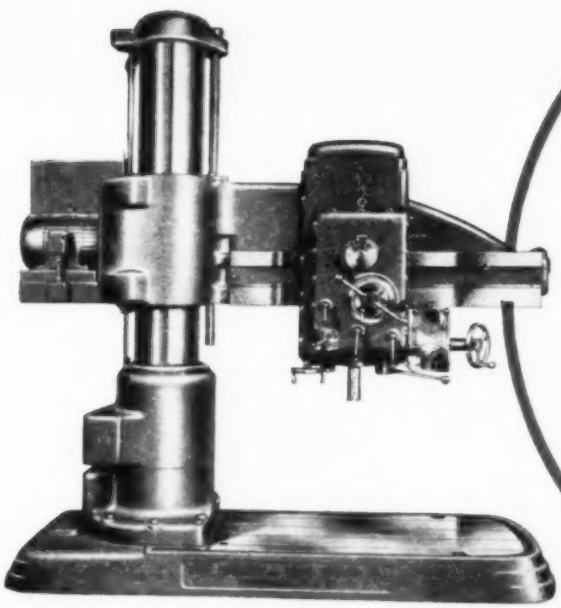
. . . that Reflects not only LIGHT . . . but QUALITY



All "AMERICAN" Hole Wizard Radial Drill Column Sleeves are now super-finished to a beautiful "mirror" finish.

Not only does this vastly improve the appearance of the machine but which is far more important it minimizes the danger of column cutting and scratching.

This operation is done in our own plant on a brand new 40" "AMERICAN" Pacemaker Lathe equipped with a new No. 4 Gisholt Super-finishing attachment.

This represents just another step along the path of continuous modernization to improve the quality and also the inherent value of "AMERICAN" Lathes and Radial Drills.

Descriptive bulletin No. 328 will be of interest to you. It illustrates and describes many new and exclusive features.

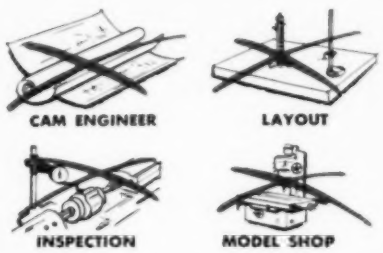
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 243 READER SERVICE CARD

SHORT-CUT TO PRODUCTION!

ONE STEP INTO THE FUTURE ELIMINATES THESE COSTLY STEPS OF THE PAST



Numeri-Trol slashes lead time from months to days, cuts changeover time from weeks to hours; here's how:

Typical fuel control cam production process is simplified to (1) preparation of machine control tape *directly from engine designer's performance curve*, and (2) inserting the tape into Numeri-Trol's control cabinet for *fully automatic production!*

NUMERI-TROL

59-29

Tape-Controlled Cam Milling Machines by Ex-Cell-O

Designed to Save Time!

- Drastically cut lead time, eliminate tooling costs, reduce machining time of cams for aircraft or missile fuel systems, small turbine blades and other complex prototypes and production parts.
- Precision-built especially for use with high performance pulse data inputs.
- Rugged construction with anti-friction table and cross-slide bearings, and servo-actuated hydraulic drive motors.
- Lateral movement of work head, transverse cross-slide and 360° work indexing are fully tape-controlled.
- Simple control and automatic functions eliminate human error.
- No need for blueprints or models. Numeri-Trol permits maximum security for advanced projects.

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CIRCLE 244 READER SERVICE CARD

American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Invitation to Disaster

Remember the initial shock of disbelief when news of the Pearl Harbor disaster came over the air that fateful Sunday afternoon in late 1941?

The Japanese caught our Navy, and our people in general, in the midst of complacency. It took the loss of much of our fleet to awaken us into action.

Today the same complacency . . .

is exerting an insidious influence in our armed services and in U S Metalworking in the area of defense production. It is exposed for what it is in the recently completed study by Johns Hopkins University of the Army production base and the national production base. Detailed story of the study is on page 89 of this issue.

The critical situation confronting us can be simply stated. The federal government and the armed services have shown proper concern about modern weapons, but have sadly neglected the source of production of these weapons—modern machine tools.

Our military forces cannot secure modern weapons without modern means of production. The condition of the Army's machine tool inventory is deplorable. Most of it dates from World War II and Korea and only a negligible fraction of it is under five years of age. It is obsolete, worn out and incapable of working to today's standards.

The condition inside . . .

the metalworking industry is not much if any better than inside the Army. Machine tools installed in the nation's shops are preponderantly overage, average 13 to 15 years, and constantly are getting older. Continuation of the present trend means that by 1965 the percentage of overage machines will be considerably higher than now.

Just a fraction of the nation's machine tools are capable of doing an efficient job in producing sophisticated weapons of today's and tomorrow's designs. Contrariwise, obsolescence and wear rule out a large proportion of the nation's machines as available to meet requirements of a modern military production base.

This is a day when, if we are to manufacture the weapons that we must have, new levels of precision must be attained, tougher metals must be worked, and higher power and greater ruggedness must be built into machines. What's more, the rapidity of development of new designs of weapons must not be thwarted by the inflexibility and inadequacies of out-moded machine tools that comprise the sole available production facilities. The Army and military goods contractors should be able to take advantage of such new principles as building-block construction and automatic electronic programming now offered in new machine tools.

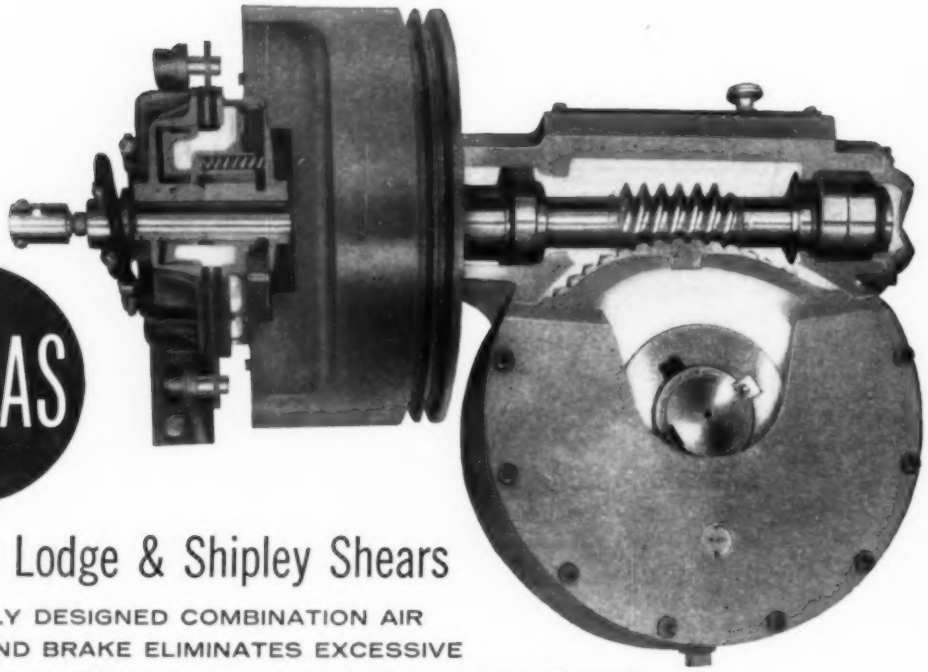
There is only one solution . . .

to the incredibly bad situation confronting the Army and the nation: massive modernization of production facilities in thousands of contractors' plants as well as inside the Army. If our armed forces are to have the kinds of new weapons in the quantities needed in 1965, this modernization program must begin immediately.

Leadtime for manufacture of today's more complicated machines is lengthening. At the same time, the period for preparation to meet an international crisis is shortening. Hence, postponement of modernization until we are in a national emergency would be a direct invitation to disaster.

Burnham Finney EDITOR

on the machine . . . not on the invoice!



EXTRAS

Only on Lodge & Shipley Shears

...SPECIALLY DESIGNED COMBINATION AIR CLUTCH AND BRAKE ELIMINATES EXCESSIVE MAINTENANCE COMMON ON HEAVY DUTY PLATE SHEARS

The "standard extras" you find on Lodge & Shipley Shears, although not reflected in the price, are important in time-saving, effortless operation, accuracy and low-cost service.

THE COMBINATION AIR CLUTCH AND BRAKE, for example . . . its single unit design positively eliminates overlap between clutch and brake. Disc-type construction is self-adjusting for fast, smooth starting and safe, positive stopping. The clutch provides automatic overload safety; the brake applies automatically in the event of electrical or air supply failure.

NO OTHER SHEAR, EVEN AT EXTRA COST, can offer the exclusive combination of features found, for instance, on the ½" Lodge & Shipley Shear:

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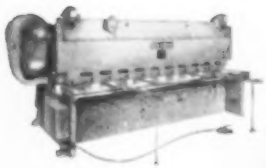
- Remote-operating Foot Control • Ball Transfer Table
- Motorized Front-Operated Back Gauge
- One-piece Shaft with Integral Eccentrics
- Blade Clearance Indicators • Air Counterbalances
- Air-cushioned Back Gauge • Blade Changing Jigs
- Fast, One-man Upper Blade Adjustment
- Independent Holddown Fingers • Quad-life Worm Gear



Capacities to ½" x 12'

Find out how much more you get . . . **WITHOUT EXTRA COST** . . . on a Lodge & Shipley Shear. For details, see Sweet's Machine Tool File or request Bulletin No. PS-15 from: **The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio.**

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Johns Hopkins study for the Army asks:

Can we prevent a PRODUCTION PEARL HARBOR?

By Burnham Finney, Editor

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If the Army is to develop modern weapons and produce them at the desired rate, and if it is to keep production costs within bounds that the nation can financially afford, it must put into effect immediately a machine tool modernization program. This program should encompass the purchase of 5000 to 6500 new machines of today's advanced designs, costing around $75 million, each year for a number of years ahead.

Beyond that, if the Army is to get the modern weapons its various assignments require, military procurement costs must drop sharply the next five years. The only effective way to achieve such savings is massive modernization of the nation's metalworking production facilities, not only inside the Army's own operations but in thousands of plants that have prime military contracts or subcontracts.

Lead-time is getting shorter

Unless such modernization occurs, so that today's advanced production technology can be applied to manufacture of weapons, the United States will lag in development of new military items (held back by available out-of-date production equipment), costs will become prohibitive because of the rapid deterioration in the efficiency of obsolete machines, **and leadtime for machine tools in the next emergency is likely to rise to 30 months or more, compared with 12 months during World War II and 24 months during Korea.**

Such are the conclusions arrived at in a study of the Army's machine tool policies by a John Hopkins University team, reliable reports say. If present policies continue, the Army's machine tool inventory will have so many obsolete machines by 1965 that it will be virtually useless for production of 1965 weapons.

May become DOD policy

The Johns Hopkins study is said to have important implications for all three of the armed services and may well become a Department of Defense document, the basis for carrying out the DOD modernization and replacement program that has been pretty much bogged down since its start a few years ago.

The study's chief conclusion is: You cannot have modern weapons without modern means of production. **To support this conclusion, the study is reported to recommend that the Army's machine tools be put into tooled-up plants which would be working on current requirements rather than be stored in so-called "production packages" or in warehouses.** Almost all of the plants would be operating at a small fraction of capacity. The sustaining equipment in the plant (machines not employed on current production) would be in the ratio of 20 to 1 to the equipment actually at work. This ratio would be based on a two-shift operation.

Based on AM Inventory

Basing many of its projections on the 1958 AMERICAN MACHINIST Inventory of Metalworking Equipment, the Johns Hopkins study is reported to advocate full modernization of the U S production system if U S world leadership—politically, militarily, economically—is to be maintained. Advanced technology is available, but not used. For that reason, we are rapidly losing the advantages in technology that we have had for many decades. **The western European countries, and Soviet Russia, are outstripping us in economic growth.**

USSR replacement conscious

Soviet Russia, in fact, is more sensitive to the dangers of machine tool obsolescence and what that means to the economy than is the United States, the study is reputed to point out. It has gone on record with the belief that new equipment should be replaced in less than 10 years from its installation date. If that is not done, introduction of new technology will suffer intolerable delays.

Six-year top performance?

The average machine tool can be expected to work with new machine tool accuracy for about 6000 hours, the study states. Major preventive maintenance will extend its useful life, with new machine tool accuracy, another 6000 hr. If the machine works on a 40-hr-a-week basis, its first-line performance will not be longer than six years.

Faster obsolescence today

Under the impact of technological development, according to reports of the study, machine tools have been becoming obsolete faster. Prior to 1940, obsolescence took 15 to 20 years. For years after that, it speeded up to 8 to 10 years. **By 1960 it probably will not be longer than five years.**

The deterioration cycle of machine tools has shortened for a number of reasons, two of which are of prime importance. First, new levels of pre-

cision involving 0.0001 in. are a different matter from precision levels of 0.001 in. Second, the ability of today's machines to remove metal involves far greater stress than operation of yesterday's machines (and frequently is five to ten times more than that of machines of 1949 design). Other factors: tougher metals now being worked, much more rigid cutting materials (carbide and ceramic tools), more horsepower. As the working of metal thus becomes increasingly an operation of high power and precision, the expected life of machine tools declines sharply.

Tax haggling

Yet, the study reportedly comments, the U S Treasury still bargains with machine tool users, for tax depreciation purposes, on the basis of a schedule of expected lives (Bulletin F) that was obsolete 20 years ago. The Defense Department's schedule of useful lives is correspondingly obsolete.

Building block developments and automatic electronic programming will be responsible for profound changes in manufacture of both civilian and military products, the study is said to claim. The rigidity that has been characteristic of mass production in metalworking will begin to disappear as building block systems make basic redesign possible.

Engineering-change leadtimes

Engineering changes are being made frequently in almost all complex military equipment. Modern programming methods will allow such changes with least disturbance and in a shorter leadtime. Spare parts can be produced in small lots for weapons without delay, thus reducing or eliminating the problem of large surpluses. Research and development will be speeded up by automatic programming (leadtime on a 1000-hp gas turbine engine was reduced by one year). Best of all, automatic programming offers the possibility of designing directly for production. **During the next 10 years many engineering concepts will be translated directly through punched tape or through cards to the production system.**

Many new techniques

Military applications of new metalworking techniques now coming into use are potentially as numerous as possible industrial applications, the study reputedly points out. These techniques will make possible operations or qualities not otherwise available. Ultrasonic cleaning already is being employed for high precision parts. Ultrasonic welding of dissimilar metals or foils has been effective in cases in which no other method is possible. The plasma gun is able to weld high temperature materials in temperature ranges beyond the reach of other methods. Explosive forming is a fast, cheap method of forming heavy rocket nozzle plates and doing other military work. Fairly rapid extension of rotary extrusion, currently used in missile component manufacture, is ahead.

The study comments on advances in the strength of materials. In airframe materials, changes seem to have moved at a fantastic rate. The working of such metals will require continuing development of old and introduction of new machining methods. At this point, it is not clear whether the new methods will displace or merely supplement established processes.

Material improvements, too

Many of the new methods not only work the material but change its basic properties, many times resulting in a major improvement in the quality of the material. This factor, the study asserts, is evident in the missile development programs. Requirements include increased heat and wear resistance, higher yield points and lower fatigue levels. The materials available in the early stages of the programs and conventional ways of working them did not meet design requirements. Developments of new methods has taken time and is still in process—a major factor in greatly extended missile leadtime.

New products, new methods

Production technology should progress about the same as product development, the study is reported to conclude, otherwise serious production delays will occur. **Every major advance in military equipment design is almost sure to need a concurrent advance in production technology. The study is said to warn that U S industrial prowess no longer is assured in a time when weapons technology is moving so rapidly.**

The Army has 85,000 to 90,000 machine tools, the study is purported to reveal, of which around 75,000 are of the cutting type. These machines are regarded as the critical element in the Army's industrial production base to be drawn on to break manufacturing bottlenecks in an emergency. **About nine out of ten of these machines were built either in World War II or in the Korean period; and almost three out of five are in storage. Possibly as many as one out of four are being operated at low rates in government-owned, government-operated facilities.**

Production packages

A sizable proportion of the inventory is stored in "production packages," on the theory that all the machines in a production package could be assembled and put into operation quickly. The Johns Hopkins study is reported to challenge this theory, because shifts in products and in materials require different machines and machining processes. On one major weapon, around 70% of the parts were changed, with corresponding changes in tooling, jigs and the basic machines. A Ford Motor Co study of a medium tank package arrived at the same conclusion—that the theory is invalid.

Rebuilding of overage machines is not a process that can modernize an old tool, the study is said to declare. Improvements can be made but the machine cannot be brought up to modern standards. Obsolescence begins on the day the machine originally leaves the factory and its basic characteristics remain substantially unchanged, regardless of reconditioning and rebuilding. Incidentally, only around one-sixteenth of the Army's machine tools is classified as new, compared with one-third in the Navy and Air Force.

More new reserve machines?

The Army reserve does not contain any appreciable number of machine tools less than five years old. This fact is critical in considering any advantage that the reserve represents in leadtime. **If a number of new long leadtime machines must be procured to supplement machines from the reserve in creating a production line in an emergency, any savings in leadtime disappear. In 1957, the study states, it was possible to meet from the Army's inventory less than one-fifth of the requests for reserve machine tools for missile production.**

Defense contractors are not willing to accept from Army reserves old machines that do not meet the specifications of modern machines (despite the fact that private industry itself, in most cases, has an excesssive number of overage machines of its own and is slow to spend its own money to replace them).

The condition of Army reserve tools, as coded, is an unreliable and misleading basis upon which to allocate or accept tools for particular purpose. More than that, the study

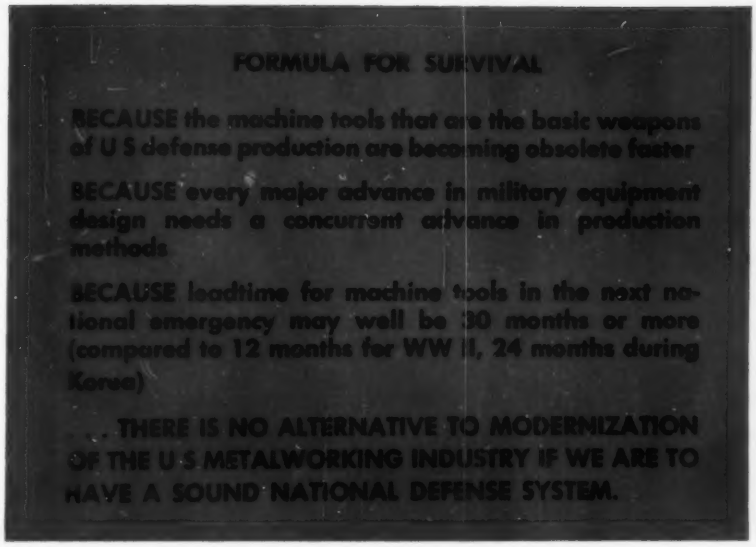
charges, the feasibility of machine test procedures is questionable. Tests are expensive (25 manhours for a machine), test facilities are limited, and there is no assurance that after being tested, a machine will reach the contractor in good condition ready for use. Most deficiencies revealed by test could be detected by detailed inspection, but there is reason to believe that routine inspection is of little value in determining the condition of a machine.

A large percentage of the Army's machine tool inventory should be classed as poor, the study asserts. Processing of machines for storage has frequently not been in accordance with instructions and damage has resulted. Many reserve machines do not have the standard accessories going with a new machine. Instructions and records have been lost. **The condition of much of the inventory is such that the machines will need some kind of rehabilitation or reconditioning before they can be used at all.** Since the Korean conflict, there has been a continuing decline in the quality and composition of the inventory.

Advantages of modernization and replacement can be boiled down to an increase in capacity, in versatility and in quality of work performed. In two industries—automobiles and electrical machinery—the benefits of modernization can be put into terms of increases in capacity and decreases in numbers of machine tools. The increased capacity stemming from modernized production facilities is especially important in the military sector because of the urgency of developing a reserve against any future emergency needs.

A more versatile production base, particularly one with numerically-controlled machines, would contribute substantially to reduce R&D lead-time, the survey is reported to state. If design is to be liberated from the limitations imposed by outmoded equipment, modernization is absolutely essential.

The Army inventory of machine tools does not represent an adequate production base. Military equipment procurement costs are rising, partly because of increasing inefficiency of available production equipment and partly as a consequence of poor use of existing machines. The pressing budgetary problems of the services are such that economies in production costs must be made or fewer weapons can be produced. These economies, the Johns Hopkins study points out, can only be achieved by modernizing and replacing overage, obsolete and wornout machines.


FORMULA FOR SURVIVAL
BECAUSE the machine tools that are the basic weapons of U S defense production are becoming obsolete faster
BECAUSE every major advance in military equipment design needs a concurrent advance in production methods
BECAUSE leadtime for machine tools in the next national emergency may well be 30 months or more (compared to 12 months for WW II, 24 months during Korea)
. . . THERE IS NO ALTERNATIVE TO MODERNIZATION OF THE U S METALWORKING INDUSTRY IF WE ARE TO HAVE A SOUND NATIONAL DEFENSE SYSTEM.

A production base modernization program should be tied to classes of products, not to specific products. It also should not be tied to a given year. It should be capable of dealing with varying requirements, such as the increasing sophistication of modern weapons, the modernization of Army combat equipment, and the supply needs of our allies.

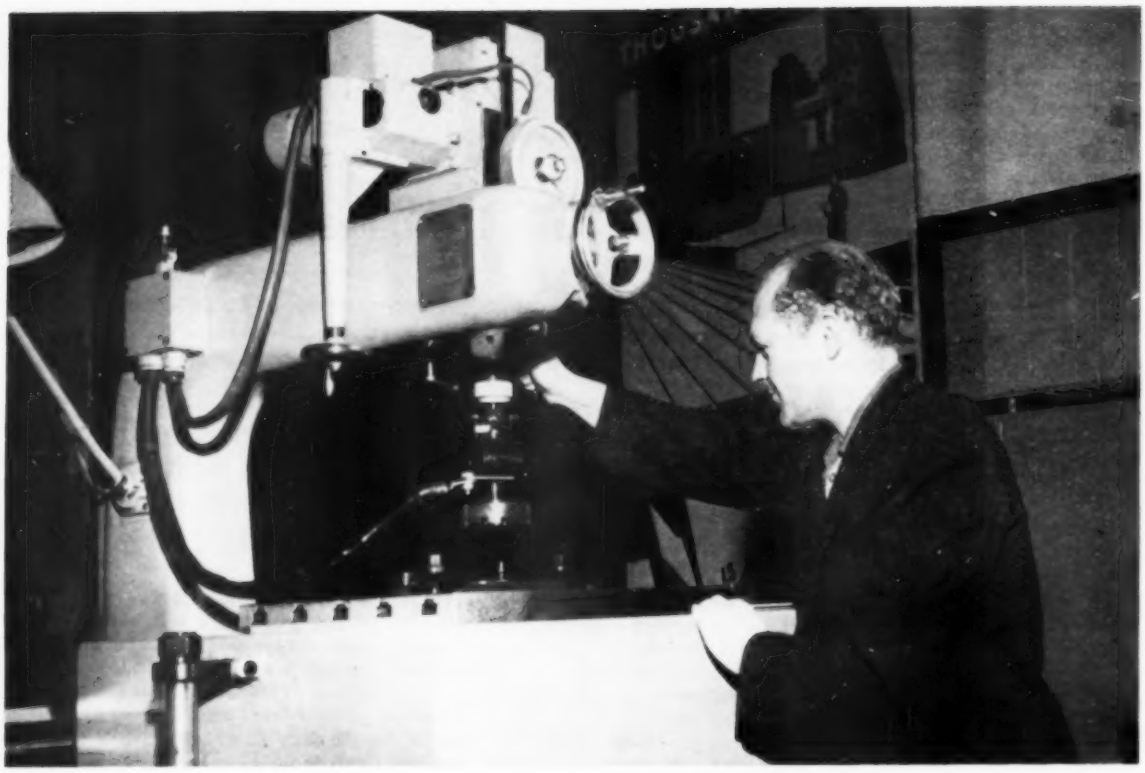
Between 750 and 2000 machine tools must be bought each year for the next few years if the Army is to maintain its production facilities even at a minimum level of efficiency, the study concludes. When the newer machines, such as numerically-controlled units, start coming in after 1960, the Army's machine tool requirements may double or triple. If leadtime is to be kept as short as possible and production delays avoided, modernization should begin in the current fiscal year 1960 to meet 1965's new-weapons needs. Planned modernization will sharply reduce the number of machine tools required, will cut drastically the number of inactive tools, and will increase greatly the production capacity in place and in reserve.

Too many overage tools

The Johns Hopkins study cites the inventory of machine tools in the metalworking industry as preponderantly overage, averaging 13 to 15 years and constantly getting older. These conclusions are taken from the 1958 AMERICAN MACHINIST Inventory of Metalworking Equipment. **If the annual net retirement rate of cutting-type machines is upwards of 30,000 units and the annual purchase rate of new machines is 60,000 units tween now and 1965, the percentage of overage tools will rise from its present level of 60% to 67%.**

It thus is apparent that obsolescence and wear will rule out a large proportion of the U S machine tool inventory, both in the military and private-industry sectors, as available to meet requirements of a modern military base. Contrariwise, only a fraction of the nations' machine tools are capable of doing an efficient job in producing today's and tomorrow's advanced weapons. For this reason the problem of securing competent subcontractors for defense work is becoming increasingly critical. **Whereas the government and the armed services have shown proper concern about weapons, at the same time they have neglected the source from which these weapons must come —the machine tools of American industry. By contrast, Russia is awake to this situation and is putting major emphasis on modernization of its productive facilities.**

Full modernization of U S metalworking facilities, the study is said to conclude, could be met by an annual outlay of much less than 2% of gross sales and would provide by 1965 the modern, versatile production base needed by advancing weapons technology. The savings in metalworking costs on military items alone would more than cover the capital outlay. If there is to be a sound national defense system, there is no alternative to modernization of the US metalworking industry.



Is Russia widening the "spark" gap?

By Samuel C Ratmansky,
electrical discharge specialist,
International Resistor Corp,
Philadelphia

An important new circuitry for electrical-discharge machining is being demonstrated at the Soviet Exhibition of Science, Technology and Culture at New York's Coliseum. Called an "impulse generator," the circuitry on the machine demonstrated removes about one-third of a cubic inch of hardened steel per minute with 28 kw of power.

Admittedly, the circuit has been copied by both Japanese and French EDM manufacturers. It is likely to be adopted by some US machine builders—perhaps to even greater advantage as it is combined with America's somewhat better tooling approaches.

Here is a detailed analysis of the Russian machine and circuit, its design and operation, based on a lengthy discusison with Valeri Solovov, chief EDM designer, ENIMS, Moscow. Photographs of the equipment have appeared in AMERICAN MACHINIST on July 14, '58, p 93 and July 13 '59 p 105.

Power supplied by a rotary generator of 28 kw, at 380 volts dc, and operating at 2800 rpm, feeds electrode from 5 amps on a finish cut to 230 amps on rough cut, at 32 volts for all finishes. (For New York City's 220 volt ac, 60-cycle current, power is rectified before entering the generator.) The cutting current is pulsed at 400 cps for all finishes by a gas-tube switching circuit. There is no provision for anti-arcing shut-off. The complete firing cycle is 10^3 second, and the firing-cycle energy period was 10^4. The wave pattern is square and completely above the line. This square-wave pattern, plus the slow pulsing rate, achieves a very low rate of electrode wear—when the electrode is graphite.

On this machine, a 20 x 24 in. table is completely accessible for set-up as tank walls, for containing the kerosene dielectric, rises and falls to expose the table and work. The table moves longitudinally when a hand wheel on the right front of the machine is turned. Cross travel is provided by a tool-holding overarm. Both movements are measured by micrometer collars and engraved scales containing fractional millimeter graduations.

A servo moves the quill during the cutting period, and quill travel is measured by a built-in indicator. Quill range is 6 in., but does not appear to be sufficiently substantial for large diameter work—tilting and floating seem possible. The overarm is a rigid casting, properly supported and seems stable for distortion-free cutting. The servo is set up to actuate a gear train which drives the quill. The machine does no hunting during roughing, but a built-in vibrator moves the quill at 60 cps in a 0.002 in. amplitude to cut blind holes without pressurized coolant flow. Kerosene dielectric is filtered as part of the pumping system. This machine tool is sturdy, has power traverse where convenient, and includes quality finishing, even to hand scraping where necessary.

The metal-removal rate for rough cuts with a minimum of 16 sq. in. working area is 5,000 cubic mm a minute or approximately 0.305 cu. in. per min. This is 30 times faster than American machines previously observed sinking molds. Surface finish on rough cuts, using a graphite electrode having a flat-ground face of 30 rms, is 650 to 1000 mu-in. rms.

Metal-removal rate for medium-finish setting is 0.10 cu in. per min., and was observed and measured on my own sample of Starrett hardened gage stock, which was cut by a graphite electrode supplied by Mr. Solovov. Surface finish runs 500-600 rms. Metal-removal rate for fine finishing is 0.01 cu in. per min. It was shown on the other side of my gage-stock plate with a copper electrode to about a 175 rms finish. Largest cutting area possible is 60 sq. in. (which I believe results merely from the machine tool and not from the power pack). The smallest area that can be cut is 0.125 in. dia.

Electrodes are machined from graphite on vertical mills. Tracing equipment is used to sink die cavities. No oil holes are used. Usually, only one roughing and one finishing electrode are used as the graphite wear rate is 1:20 to 1:50. Allowances are made in electrode sizes as over-cut is 0.032 in., diametrically, on roughing. The over-cut is down to 0.008 in. on finish cuts. Die taper is 0.002 to 0.004 on a 1-in.-deep blind cut. For a piece having 4 or 5 sq in. of working area, only medium power can be used even on rough cut. Internal corner sharpness is about 0.010 in. radius. No oil under pressure is used at the cutting gap. The part is merely immersed. Vibration produces agitation and circulation.

Graphite electrodes are screwed to a backup plate which has a ⅝-in.-dia shank for insertion in to the quill opening. No orientation flat is used on the shank, nor is any other holding method used with the quill. Orientation is through matching edges of the electrode holder.

Because of their low wear rate, electrodes are used several times before discarding them. When better finishes are desired, copper electrodes are used at 5 to 10 amps during which time the metal-removal rate drops considerably.

Oil under pressure can be used on through slots by having the work contain a hole in the area where cutting will take place. This is necessary when cavities achieve depths of 2 in. or more.

While the 1G EDM cuts fast when given enough working area, burning of the work is always a hazard. It happened twice during my demonstration. It is possible that a slightly higher voltage could open the gap and eliminate this problem.

Graphite electrodes could be made by power metallurgy, by pressing powdered graphite and a binder into a mold which would allow for shrink. The compacted graphite could be sintered and then mounted to fit the electrode-holder.

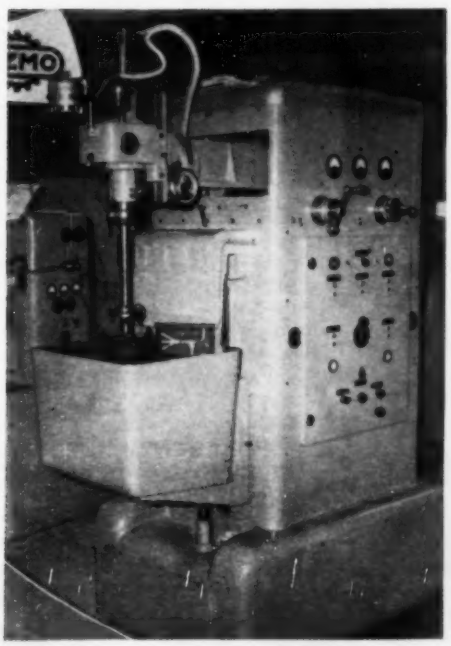
As the surface finishes are quite rough, this machine lends itself to large forging dies, sheetmetal-forming dies, and to rough machining plastic and diecasting molds. These pieces can be finished on another machine. Between 0.005 in. and 0.010 in. of stock would be left on a side for the cleanup cut.

By using American tooling methods for EDM cavity sinking, this machine could cut more accurately and to better finishes. An anti-arcing device would have to be incorporated to prevent dc continuous arcing, which could ruin dies by burning.

Cost of this machine tool in the USSR is 18,000 rubles. As the official exchange rate is four rubles to one American dollar, this would indicate $4,500—. This size of machine tool, with its cutting capacity, in the USA could cost from $100,000 to $150,000. This machine is not available for export to the USA.

Machines now under consideration will have 50 kw generators, which should up metal-removal rate to about 30 cu. in. per hr in steel with graphite electrodes—using a 25 sq in. working area and producing a surface finish of 750 to 1250 mu-in.

Benching EDM-cut dies will be relatively easy on large work where powered air grinders are able to enter the cavity. An accuracy of plus or minus 0.010 in. on large work can be obtained with proper tooling procedures.



COMPARISON TABLE AVAILABLE

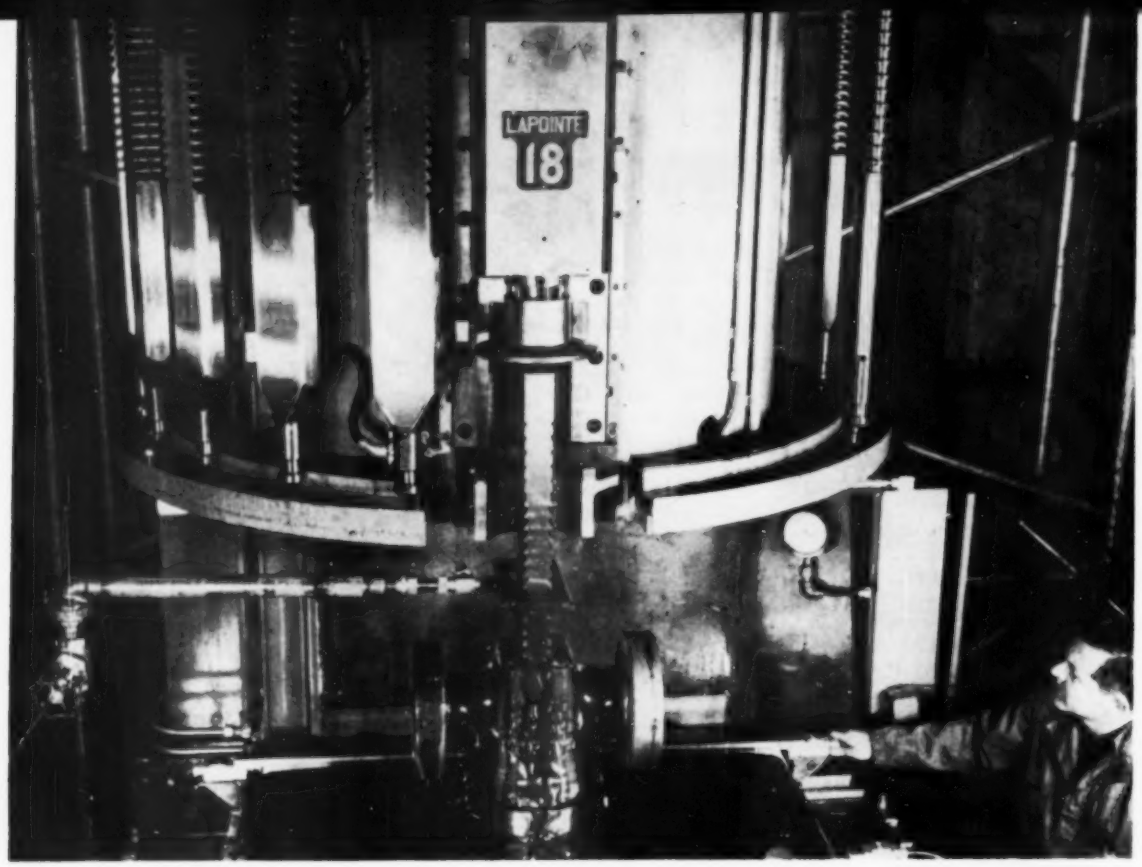
A detailed table, prepared by the author and comparing significant details of design and operation for the Russian machine, the Matson machine and the Elox machine is available without charge. Write Reader Service, American Machinist, 330 W 42nd St, New York 36, N Y.

POLAND IS GETTING INTO THE ACT

At this year's Poznan Fair, Poland turned up with something like 50 types of machine tools never before produced by that country.

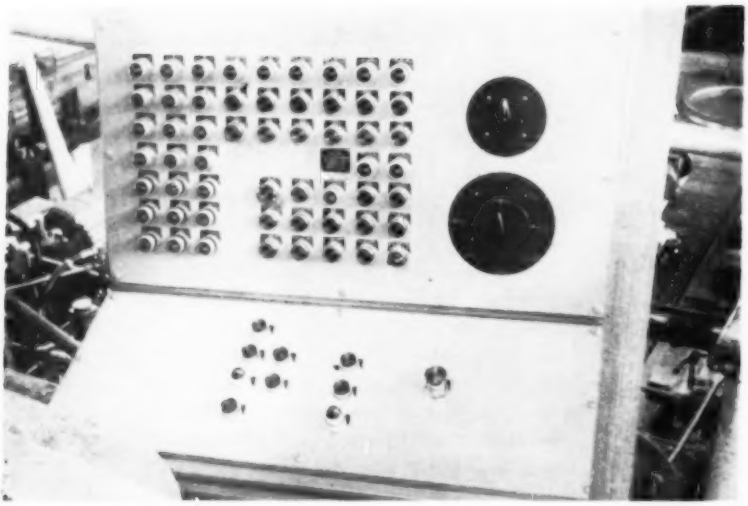
Star attraction was the made-in-Poland EDA-35, largest of several electrical discharge machines on exhibit. Intended for die - cutting a maximum area of 23 square inches, the machine has a separate motor for spindle rotation so that symmetrical forms may be sunk and tapped.

Spindle swivels through ± 30 degrees. Horizontal location is done by slides enclosed in the console. Maximum vertical travel is 39 inches. the dielectric tank is raised by lead screw to immerse work clamped on 14 x 20 in. table.



Six-foot diameter turret . . .
of this 60-ton pull vertical broach holds 20 80-in. broaches which index automatically to machine a hole to finished size. Each broach is pulled dead in line with the center to eliminate the stresses encountered in off-center pulling

Giant turret broach increases

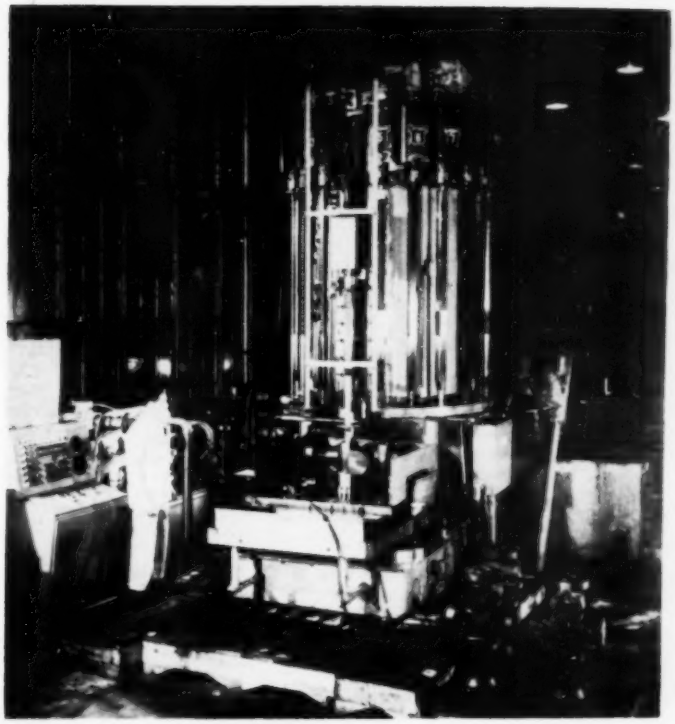


Control panel . . .
is a compact unit, simplified for easy maintenance. Operator uses large dial at right to select finish hole size and a selector switch to position broaches to cut in-line or crosswise to the axis. After controls are set, built-in programming does the rest

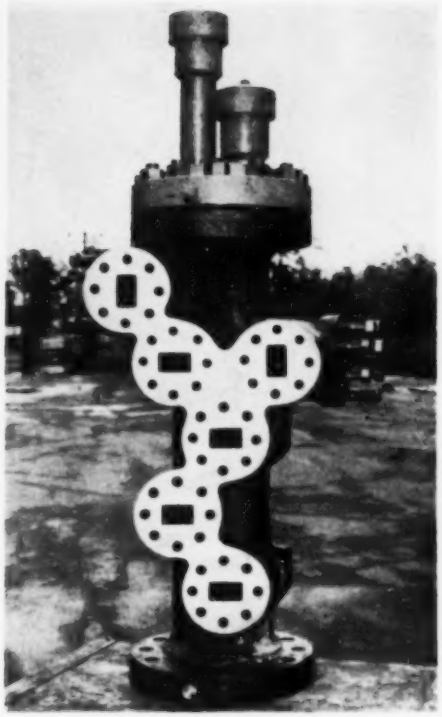
A giant pull-down broaching machine with two brand-new features —a 21-station turret and a dead-center pull on the broach—has increased production of oil field gate valves for Cameron Iron Works of Houston, Texas, by 3800%. The machine, built by Lapointe Machine Tool Co of Hudson, Mass, is a 60-ton pull, 78-in. stroke unit, with built-in programming. All the operator has to do is load the workpiece, select the finished size, and set the controls for automatic cycling.

Each finished hole size is built-up by using a group of broaches in a fixed sequence. After the operator selects the hole size, he sets the hole size control switch. The broaches are then automatically indexed in correct sequence to provide the finished size.

Each of the stations on the 6-ft dia turret, except No. 21, holds an 80-in. long broach. Station 21 is an open station for any type of broach to per-



Thirty-six-foot high machine . . .
has a considerable portion pitted below floor level, including hydraulic cylinder and chip conveyor system



Six-way oil field gate valve . . .
has holes broached at the rate of one every 15 minutes. Slotting required 13 hours per hole

valve production 3800%

mit the machine to be used for conventional pull-down broaching. The turret has variable-speed hydraulic motor drive, preset by the operator, and can be manually controlled.

Lapointe enginers claim that the in-line, dead-center pull eliminates the stresses and strains encountered when pulling a large broach off-center. Using the pull head attached to the end of the piston rod, the broach in this machine is pulled dead in line with the cylinder. It is held securely at top and bottom during the entire working portion of the broaching stroke and is guided for the full length of the cut on hardened and ground ways. The dead-center pull operates so smoothly that it is possible to get finishes as fine as 20 to 25 microinches.

Broached openings in the valve forgings range in size from 2⅜ x 2¾ in. to 3 x 7¾ in. Length of cut varies from 7 to 12¼ in. Medium size valves are forgings of 410 stainless steel, and the small and large size valves are 4132 alloy steel. On a medium size valve the machine removes 36 lbs or 108 cu in. of stock.

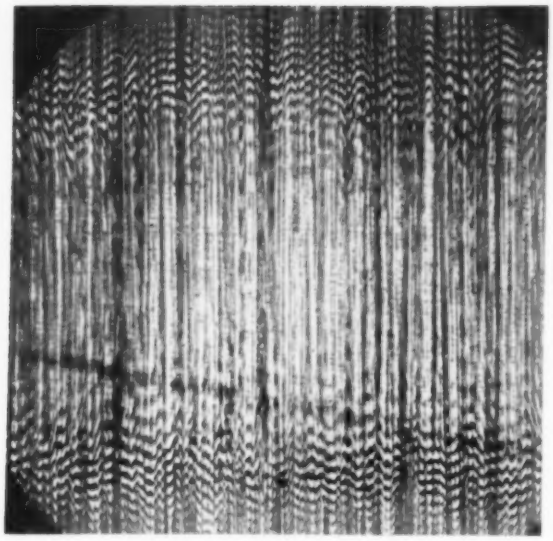
For example, the six-way valve (illustrated) requires six holes measuring 2⅜ x 4¼ x 10 in. It is broached at the rate of 15 minutes per hole for a total machining time of 90 minutes for six holes. Allowing 30 minutes for handling, total floor-to-floor time is two hours. The former method of slotting took 13 hours per hole or a total of 78 hours for the six holes. In other words, Cameron now produces holes in 39 valves in the time previously required for one valve.

After each pass, the table automatically moves away from the machine to allow the broach to return to the turret. After each hole is cut, the operator repositions the valve for the next hole by using locating pins on the table.

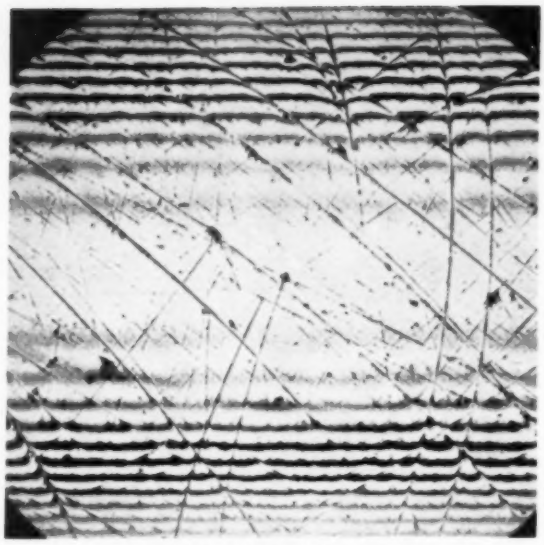
When a broach is indexed it must be in the correct position, either parallel or at right angles to the axis, to broach the hole specified. To take care of this the operator notes the hole position wanted then sets the broach position selector switch.

Cutting speed is variable to a maximum of 25 fpm with return speed of 50 fpm. Selector switch permits selection of either of two pre-set broaching speeds. Normal roughing speed is 20 fpm. Finishing speed of 6 fpm is automatically cut in by any of the finishing broaches in the turret. The finish broach has high speed steel inserts on the teeth.

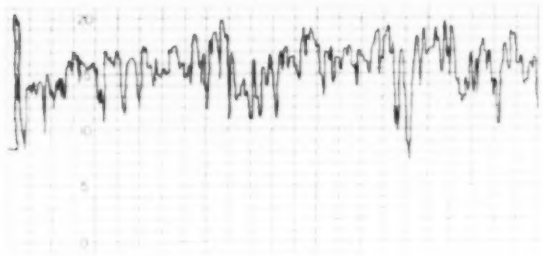
The sequence of operations can readily be changed for automatic broaching, and any station can be used as a single pass station for continuous operation with one broach. Any broach can be changed in five minutes. The machine is not designed as a single-purpose machine and can be adapted to any job that requires multiple internal broaching operations.

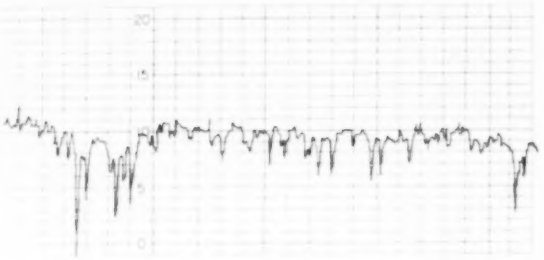


Good Quality Grinding Job



Ground Part After Microstoning





Surface Improvement . . .
Micrograph (left) of ground part (5 mu-in.) has contour lines in herringbone pattern, indicating scratch depths in the order of 12 to 15 millionths plus furrows of 35 to 50 millionths. The interference micrograph (right) of the Microstoned part (less than one micro-inch) shows straight contour bands, indicating removal of the "hills," and the greatly increased bearing area for the surface. Talysurf traces below the respective photographs further illustrate the refinement of surface-finish characteristics

"Microstoning" generates precise finishes

By Rupert Le Grand, senior associate editor

This final finishing process, using up to 1200-grit abrasive stones, generates a controlled micro-inch finish on practically any material, and at the same time corrects geometrical errors caused during previous machining operations

What kind of surface finish do you really need?

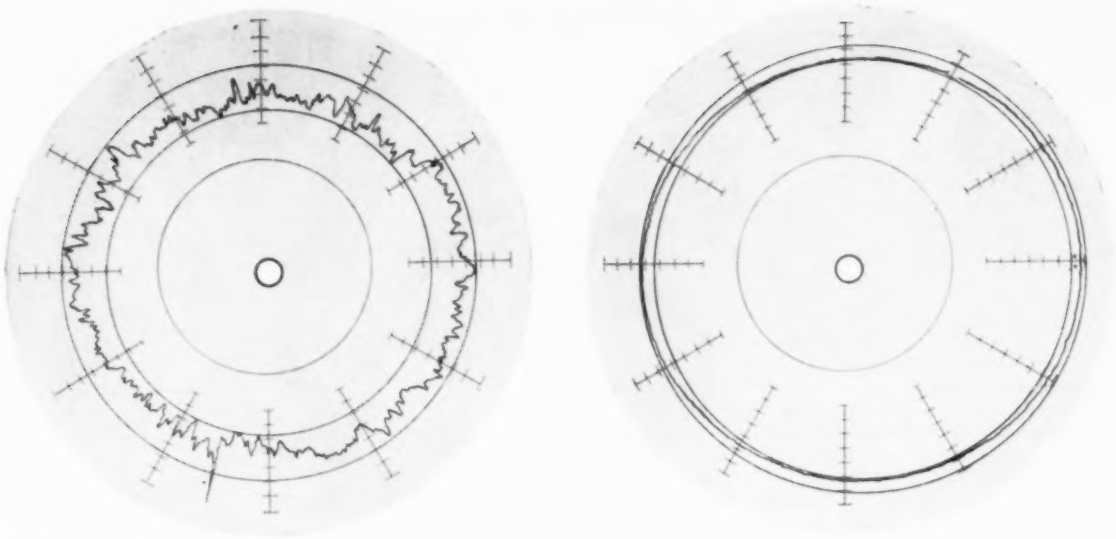
There is more to surface finish than meets the eye. You may look at a highly reflective part, and say that the finish is just what you want. Actually, an amorphous layer of material may have been smeared over the surface by polishing, and will spall if used in a bearing application. Or you may think that a reflective surface indicates a good one for a strip-roll, whereas it's a fact that a surface of less than one micro-inch may be quite dark. That's why people in the jewelry trade want a "black finish" on rolls for rare-metal strip.

Out-of-roundness is another surface-finish problem. See Special Report No. 467 "And must be round within . . ." (AM—Dec 1, '58, p109). A fine-ground part may have sufficient waviness and lobing to make it unsuitable for use. For example, a piston that is not truly round may permit excessive leakdown, if used in a fuel-injection system, a missile pump, or similar precision-parts application.

"Pattern" is probably the most controversial aspect of surface finish. Often the pattern produced on workpieces is an optical illusion of surface quality.

The production of precision parts with desired, or more properly, the necessary surface characteristics, is an expensive proposition. Fine grinding and lapping may be required, plus polishing. These steps cost money. Even so, some waviness and lobing may persist.

In the belief that economies can be realized on parts requiring precise finishes, the Taft-Peirce Mfg. Co., Woonsocket, R I, has been experimenting for some time in its own shop and at customers' plants with an American-built version of a German development. This is the Supfina method of improving the surface finish and at the same time



Waviness and lobing . . .
occur on many fine-ground parts. Talyrond charts enable the manufacturing engineer to magnify surface irregularities (here 5000:1) to detect lack of geometrical concentricity. Before Microstoning (left), the part shows an out-of-round condition of 0.000070 in.; after Microstoning, the variation is only 0.000014 in. Only an elliptical condition, caused by inaccurate centers, cannot be corrected

correcting errors in surface geometry by abrading with a stone or stones oscillating at high frequency and applied to the work under controlled pressure.

The process, called "Microstoning," need not start with a finely finished surface. Roughness up to a point is desirable, because the stones are dressed by the peaks of the scratches. Most hardened steel parts, for example, need not have better than a 20 mu-in. finish. By starting at this point you can remove chatter and feed marks, waviness and lobing by using two or three stones of successively finer grit. Condition of the grinding wheel spindle, the presence of vibration, etc., now become of little or no importance.

Flat surfaces can also be finished. In one case, a large annular thrust bearing was turned on a boring mill. The feed marks were removed by Microstoning, so that these marks would not ruin the 6-ft-dia lap required to finish the piece for overall flatness. Parts like hardened shear blades have been finished by fastening the Supfina attachment to a milling-machine column and clamping the work to the table (to get feed past the stone).

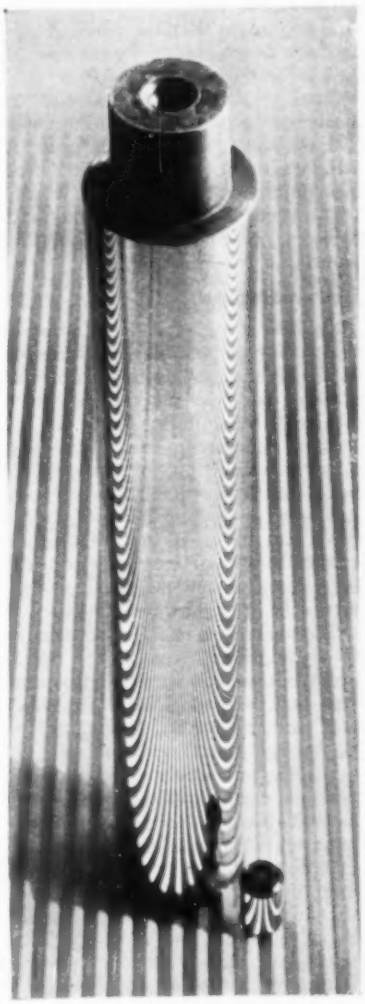
At present Supfina equipment is made in two sizes of attachments easily applied to standard machine tools—lathes, vertical turret lathes, boring mills, milling machines, and even planers. Thus, the piece can often be finished without removal from the machine tool.

Details of Equipment

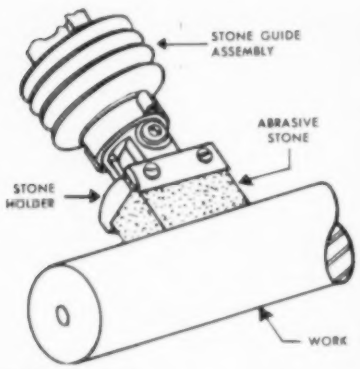
The attachment consists of a supporting frame, a head with free-floating piston, a stone-guide assembly on a dovetail slide, and a mounting bar that can be fastened quickly—as for example on a lathe toolpost. The free-floating piston inside the head moves in opposition to the body at a frequency of around 2000 ocillations per min. Because of the air-cushioning effect, there is freedom from externally transmitted vibration.

Air consumption is low, being only 50-100 cu ft. per hr for the small attachment and 100-200 cu ft. per hr for the larger one. Minimum diametral capacity of both attachments is said to be ¼ in., although ⅛ in. can be achieved. Maximum diametral capacity is unlimited for both attachments, but the larger one achieves a better production rate on work over 1 in. dia.

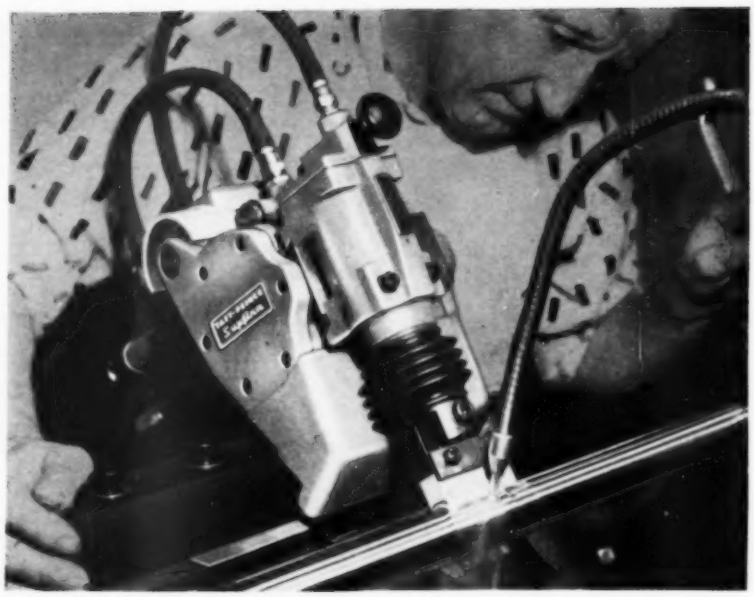
The stone guide assembly is adjustable over the entire length of the



"Pattern" . . . ▶
or a highly reflective surface is not truly indicative of surface quality. Here a plug, which was finished in a few minutes, indicates that an ultra-smooth, highly reflective surface can be realized if desired



Oscillating stone . . .
abrades rotating work, cuts quickly until remaining roughness on part will no longer dress the stone. Then process is repeated with finer-grit stones if necessary



A hardened steel guide shaft...
1¼ in. dia x 20 in. long had a surface finish of 12 to 15 micro-inches before Microstoning. With the Supfina attachment, the finish was reduced to one micro-inch in 12 min., using 500 grit and 1200-grit stones

dovetail slide and is pneumatically extended or retracted by a pushbutton valve. Ball-socket stone holders are interchangeable, and are easily swivelled to bring the stones into final alignment with the work. Adapters are available to permit use of double or triple stone holders.

Clean rinsing fluid is essential. In most cases, a 10:1 mixture of mineral seal oil and machine oil is used. A filter wagon designed by Taft-Peirce incorporates a settling tank, a cartridge-type fine filter, a magnetic baffle plate ,and a recirculating pump.

Stone materials

Because of high-speed oscillation of the stone it is possible and desirable to use silicon carbide instead of aluminum oxide in most stones used on steel. Aluminum oxide is the tougher abrasive, but dulled grit must be ripped out of the vitrified bond. Silicon carbide is more friable. Lower stone pressures and a harder bond can be used, providing good stone life and affording better control over correction of geometrical errors in the workpiece.

The stones are usually soft enough to shape themselves to the workpiece but can be shaped with sandpaper between the non-rotating work and the oscillating stone holder. Stones are made in a wide range of hardness, just like grinding wheels, with the harder grades for soft parts, and vice versa. Most Microstoning is done with stones in the 300 to 1200-grit sizes. Initial grit size depends upon the roughness of the workpiece, the final one on the finish desired. Some jobs call for final polishing with a felt-clad wood block clamped in the stone holder and the use of graded diamond pastes or a simple polishing paste.

Special materials

Soft, non-ferrous metals such as aluminum and copper present certain difficulties if a truly scratch-free surface is to be produced. Metal particles adhering to the stone can easily cause scratches on the surface. Successful results have been obtained by going directly from a fine diamond-turned surface to finishing with a polishing paste.

Soft stainless steels require relatively soft stones, used at low pressure, to prevent adhesion of metal to the stone.

Diamond finishing

High-speed steel is sometimes difficult to finish with stones because the required soft stones do not cut evenly enough over the very hard carbide matrix. The solution lies in diamond finishing. Tungsten carbide can be finished only with aid of diamond tools. Here, the diamond particles are held in a metal bond (aluminum, brass, or nickel) or a ceramic bond. A lap-like tool made of cast iron can be used with diamond paste for low-production work.

Operating conditions

The behavior of stones depends primarily on workpiece material, especially hardness and roughness, but is also influenced by surface speed, the amplitude of oscillation, the feed per revolution, and the contact pressure of the stones.

Work speed has considerable influence on cutting action. The normal starting point is around 50 fpm, but speeds of 20 to 150 fpm are used for rough and medium finishing, while speeds from 100 to 400 fpm are used for fine finishing. The important point here is that a soft stone acts harder when speed is increased and vice versa.

While the frequency of oscillation of Supfina heads is virtually constant, the amplitude (or length of stroke) is adjustable within limits (normally 0.08 to 0.20 in.). The higher the amplitude the faster a stone will cut, i. e., the softer it will act. The most common value used is 0.15 in.

The traverse feed used in Microstoning varies from 0.03 to 0.2 ipr.

The influence of contact pressure is relatively slight. Normal pressure is between 20-40 psi between stone and work.

Microstoning pattern

Each of the many thousands of abrasive grains of a stone cuts a sine-shaped groove into the work, each groove being overlapped many times by the following ones, so that only the grooves produced by the last grains at the end of the stone remain. This fine cross-hatch type of pattern is desirable in most applications.

Static switch controls ac power

Static switching devices, until now, have been based upon magnetics and solid-state physics. Now, from the field of electrochemistry, comes a promising new control component —the electrochemical relay. The small (2x2 in. is standard at present), but rugged, Ovitron control unit is capable of switching and modulating almost any amount of alternating current, endlessly and continuously, without wear, disintegration, or loss of efficiency—and without moving parts, magnetic coils or other amplifying apparatus.

In essence, the permanently sealed and encapsulated unit consists of two load-connected electrodes (tantalum) and a grid control element (platinum plated) immersed in an electrolytic bath. Upon application of a small dc stimulus to the grid element, the semi-permeable surfaces of the load electrodes become permeable to certain ions and are instantly changed from a non-conductive to a conductive state. This permits large amounts of alternating current to flow from one electrode to the other through the electrolyte and, consequently, to the load. Removal of the dc signal from the grid breaks the circuit.

The electrodes and grid element do not react with the electrolyte. During operation, small amounts of gases are formed by the action of the dc current. Through the use of a catalyst, these gases are returned to solution, thereby achieving a self-regenerative process within the device which prevents depletion of the electrolyte.

High current capacity

Though work so far has been largely devoted to applications requiring control of current in the range from milliamperes to 15 amps, there appears to be no limitation on the current carrying capacity of these devices. Current rating may be varied by increasing or decreasing the electrode surface area. Rating of the present unit is 4 amps.

As shown in the sketch, self-energized excitation can be achieved with two diodes, which block ac to the grid and allow application of pulsating dc upon the grid control element and load electrodes. These diodes may be small, inexpensive units because the current they carry is small and non-critical.

If the control switch is replaced by a potentiometer, the output current can be varied as a function of the potentiometer setting or, in other words, in proportion to the control current. Thus the device can function not only as a relay but as a power modulating unit. Ratio of control current to load current can be varied from 10:1 to 50:1.

For all practical purposes, Ovitron units are not affected by environment. Unlike mechanical devices and vacuum tubes, they are unaffected by vibration, shock, impact, moisture or position. And, unlike transistors, their operation is not influenced by temperature.

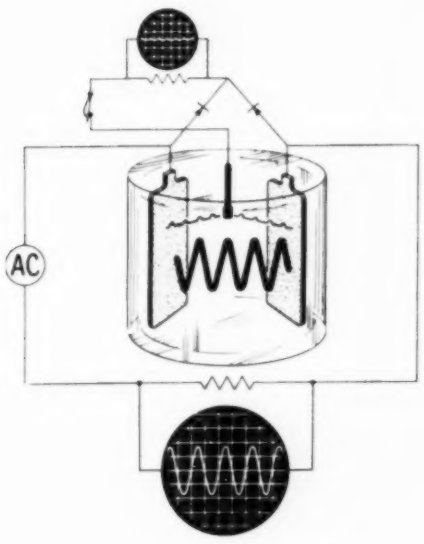
As to frequency response, present units compare to magnetic amplifiers. Maximum load voltage rating is 70 volts ac per cell, but multiple-cell units can be used to obtain higher ratings.

It is too early to quote costs, but they should be low, certainly lower than magnetic amplifiers. The materials are simple and there is no need for critical standards of dimensional accuracy.

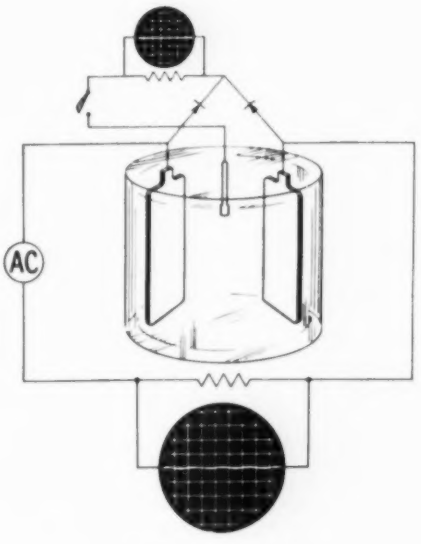
Future applications

Today the device is being sold as an ac power switch. But because of the simplicity and foolproof nature of the phenomenon upon which it is based, the Ovitron Corp, Detroit 27, Mich, feels that this control component will find many applications. Working models have been successfully tested in which the unit served as a proximity switch, logic device, circuit breaker, error detector, modulator, amplifier, regulator and time delay.

It is static, simple, wearproof—and it works.



ON CONDITION



OFF CONDITION

Restrike operation is completed in 6500-ton press as . . .

Savannah Gets Reactor

Deep drawing of carbon-steel plate more than 3½ in. thick is beyond the press-shop capabilities of most fabricators. When you go up to 6½ in. thickness and the plate is stainless clad on one side you have some more problems on your hands.

This Atomic Age is responsible. The nuclear ship *Savanah*, which came off the ways July 19, has a reactor that called for making a hemispherical head weighing 18 tons and having these dimensions: OD—111 in; ID—97 in.; depth—55 in. and thickness—approx 6½ in. plus cladding.

The fabricator—Babcock & Wilcox Co, Barberton, Ohio—faced three problems in making this huge part:

1. The usual wrinkling, avoided by controlled heat, pressure and drawing rate.

2. Differential expansion of the ASME standard SA 212, Grade B silicon-steel plate, and the 0.109 in. Type 308 low-carbon austenitic stainless steel cladding might lead to laminar defects.

3. Handling a workpiece weighing 18 tons and measuring 152 in. dia.

The head was formed on a 6500-ton vertical press, which has a daylight of 20 ft, a stroke of 9.5 ft, and operates at 3000 psi. About one-third of the press capacity was required.

After forming, flaw inspection was made by the magnetic-particle method. Prior to annealing in a car-bottom furnace, temporary lifting lugs of stainless steel were welded in place.

To accommodate a 12-ton flanged forging, a beveled welding groove was prepared on the head. The two parts were joined by the submerged-arc process. Welds were examined with a 2-million volt X-ray machine.

To develop the desired strength properties of the high-tensile carbon steel, the reactor head was heated in a car-bottom furnace until the temperature throughout was 1650 F. Spray quenching then had to be achieved within 5 min. To do this, the head was lifted into a 12-ft. dia cage consisting of vertical perforated tubes. The hemisphere was deposited onto a "toad stool" fixture 76 in. dia. Quenching to 500 F with needle sprays followed.

The formed pressure vessel was stress relieved at 1150 F for 6 hr, and allowed to remain in the furnace until the temperature reached 600 F.

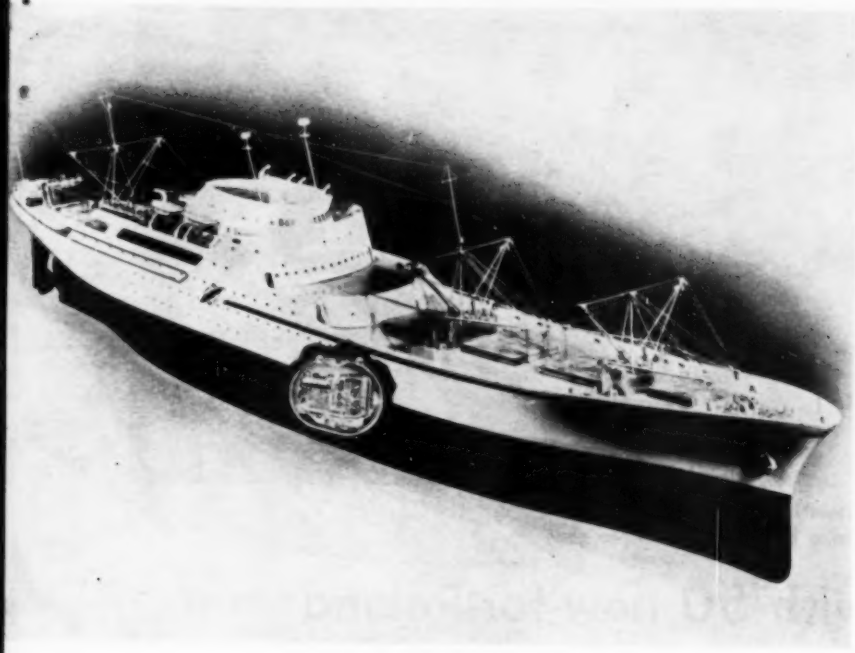
Before forming, the circular plate measured 152 in. in diameter by 6.5 in. thick and weighed 34,860 pounds. Following ultrasonic testing for laminations and other defects, the plate surface which later became the interior hemisphere was polished and clad with 0.109 in. stainless sheet. The clad plate was placed in a furnace for 7 hr to bring the temperature up a 2200 F forming heat.

Massive Tooling

Massive press tooling was required for the deep-drawing operation. The semi-steel die holder measures 167 in. in dia and accommodates die-ring inserts, made of special cast steel. The inserts are interchangeable, according to the job being run by Babcock & Wilcox.

After all fabricating steps were completed, the reactor head was tested hydrostatically. In the test procedure, a specially constructed 10-ton steel frame support was employed to position the reactor head and its vessel in an upright position. The massive assembly was secured to the test apparatus by 48 steel bolts, each weighing 350 lb, and measuring 5 in. in diameter by 6 ft. long. Threads on each bolt were silver-plated to prevent galling or seizure.

Fabrication steps—drawing, machining, welding, heat-treating—as



The NS Savannah may be called a merchant ship, but any similarity ends right there. Gone is the "tramp steamer" look. She sits long and low in the water, is designed for speed and maneuverability.

She is big: 595 ft long, 78 ft in beam and 28 ft in draft. Her single screw will push her through the water at a cruise of 21-knots, with her powerful steam turbine delivering its normal output of 22,000 shaft HP.

One fueling will last about 3 years. Range between fuelings will be 350,000 miles.

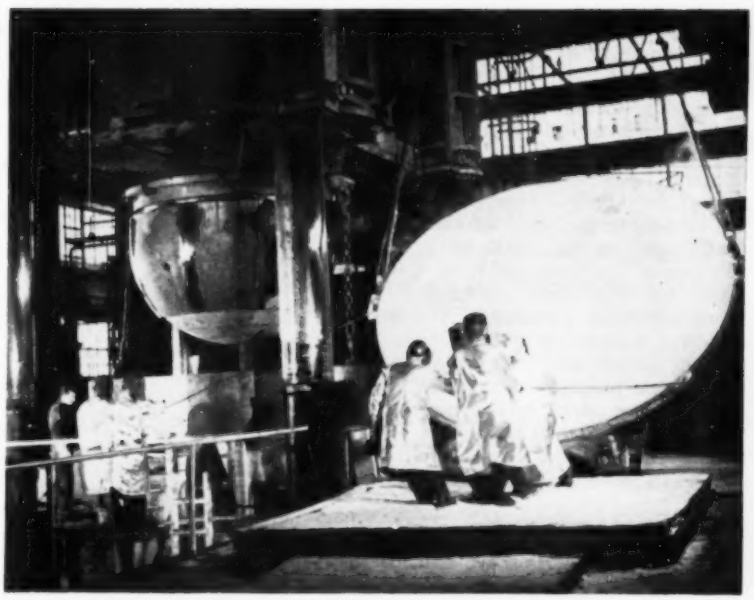
In addition to a crew of 109, she will carry 60 passengers in 30 comfortable staterooms. The 7 holds below deck will accommodate a cargo load of 10,000 tons.

With Deep-Drawn Head

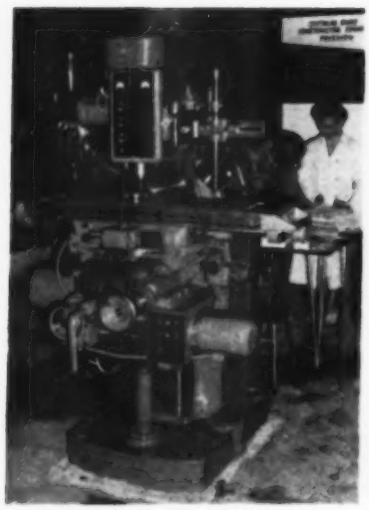
well as service environment affected the choice of cladding material. The steel containment vessel, of which the deep-drawn head is a part, contains the uranium fuel elements. Radiation affects metals as well as living cells. Stainless steel is hardened by radiation and its physical properties change somewhat, but not as markedly as with other common materials.

Corrosion resistance is an important reason for selecting an austenitic grade of stainless. Contamination of the reactor cooling water with radioactive corrosion products would be structurally dangerous, and of course would increase radiation levels beyond safe values. In addition, the Type 308 austenitic material is designed for a continuous operating temperature of 1600 F, well above the actual reactor temperature of 650 F.

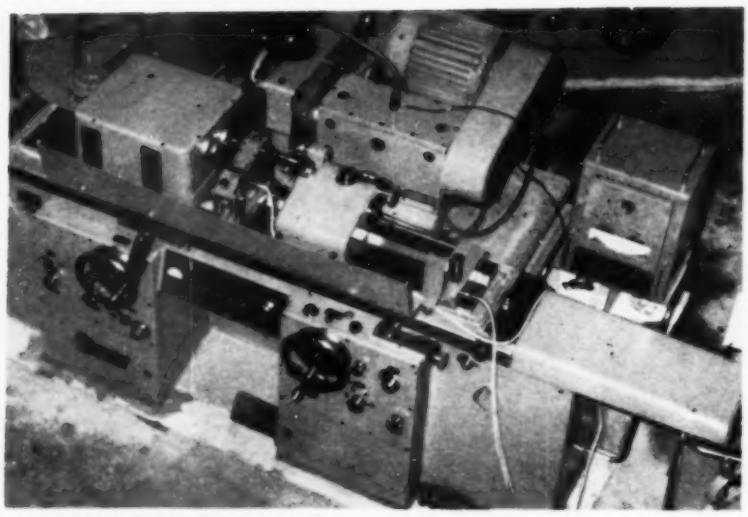
A low-carbon variety of Type 308 was chosen to avoid carbide precipitation that will occur with some austenitic stainless steels when cooling down from 1500 to 800 F. Presence of such carbides impairs corrosion resistance. However, the controlled carbon content resists formation of detrimental carbides.



Fast on the Draw . . .
Stainless-clad "blank" 6½ in. thick by 152 in. dia and weighing 34,600 lb, is heated to 2200 F, must be drawin within 5 min. of removal from furnace. The photograph shows a similar but even larger reactor head being drawn for the atomic power plant that will be installed at Indian Point, NY, by the Consolidated Edison Co



Spark-tracer mechanism controls 3-D miller spindle



Cylindrical grinder has automatic sizing by electrical caliper gage

Poles come up with 50 new-for-Poland machine tools at Poznan Fair

Half of the 100-or-so machine tools exhibited by Poland in June at the Poznan Fair were of types never before produced in that country—an indication that Poland like East Germany, Czechoslovakia and Russia is making an all-out bid for world machine tool markets.

The advanced technology of many of the machines on display—from tape-controlled millers to electrical discharge machines—gives the lie to Russia's previously announced intention of making specialists of each of the Eastern Bloc nations. Under Russia's proposed Eastern Bloc setup, the USSR and East Germany (regarded as the most technologically advanced of the satellite nations) were to have concentrated on production of complex machine tools, leaving the manufacture of such comparatively simple machines as lathes to Poland and other of the less-technologically developed nations.

Sophisticated tools shown

But this year at Poznan, Poland came up with (1) a vertical 2-D miller with punched-tape programming for cutting cams and other complex profiles, (2) several types of electrical discharge machines, (3) an ultrasonic drill, (4) two spark-copying millers for 2- and 3-dimensional work, (5) a cylindrical grinder with automatic sizing, (6) several multi-station indexing automatics, (7) a vertical boring mill adapted for copying, and (8) a large lathe incorporating a boring quill in the tailstock for simultaneous turning of the ID and OD of marine diesel engine cylinder liners up to 3 meters long and 1.6 meters in diameter.

Almost all of the machines on display at Poznan are already available for export. The Poles, who expect to produce 17,000 cutting and forming machines this year (20 times Poland's prewar annual output), say that exports account for 15% of the total. By 1965 total production is expected to run to 26,000 units a year, 5000 of them for export.

To become net exporter

By 1965, too, Poland expects for the first time to become a net exporter of machinery, with imports running at $546 million annually, as against $575 million exports. Machine tools are slated for a major role in this development, and the Poles are aiming increasingly at non-Communist markets. One third of all machine tool exports today go to non-iron-curtain countries.

Among the new machines shown at Poznan, and upon which the Poles are pinning their hopes of a rapid rise in exports:

• A 3-D copy miller (photo at left above) has spindle-head movement controlled by a spark-tracer mechanism. Tracing electrode maintains a gap of 30 microns from the metal (or moist nonmetallic master) and controls vertical travel of the cutter through a pair of powdered-iron magnetic clutches. A micrometer adjustment permits varying depth of cut for successive passes over deep profiles. Six speeds range to 5000 rpm, and the 1120 x 260-mm table has 16 feeds from 35 to 1030 mm/min.

Automatic gaging

• Cylindrical grinder (photo at right above) features automatic sizing by an electrical caliper gage that feeds in hydraulically to span the work on the final pass. Rough and finish limits are preset on an electronic unit that controls the cycle and stops the wheel feed for the finish cut. Normal tungsten carbide contact points on the gaging head are replaced by diamonds for long runs.

• Five-station indexing automatic for boring and tapping is set up from standard unit heads, all of which have mechanical drive—with feed of the boring units controlled by cams, fast approach by a separate motor, and feed of tapping units regulated by change gears. Work clamping is pneumatic, and table is electrically operated, designed to index on 75-second cycle.

Plan '59

To modernize now for growth and profits

Goes Into High Gear

In 1959, industry will spend more money than ever before to modernize its plant and equipment. But it is not spending enough to do the job that needs to be done.

Manufacturing companies* now plan to spend a total of $24.5 billion on modernization in the four years 1959-1962. This will be enough to replace roughly 70% of the obsolete facilities that were on hand at the beginning of 1959. But it will still leave us far short of our goal. It would take several years, at a higher rate of investment than is now planned, to wipe out obsolescence and give the U. S. a truly modern industrial plant.

These facts stand out from the 12th annual Survey of Business' Plans for New Plants and Equipment just completed by the McGraw-Hill Department of Economics. This new survey shows that industry has made a remarkable start on the modernization job that a previous editorial in this series described as "the most expensive task to be performed in America in this new year of 1959." The full cost of modernization has been found by the McGraw-Hill Department of Economics to be $33.3 billion for manufacturing, and $95 billion for all business.

For the past several months, McGraw-Hill publications have been devoting special attention to new developments in plant and equipment that offer opportunities for modernization. Our special effort to help industry in this regard has been called "Plan '59": to modernize *now* for growth and profits. This editorial will summarize the progress made so far with "Plan '59" and point out some of the areas where business and public policies can do still more to accelerate the modernization drive.

A Good Start

Business investment in new plant and equipment has picked up sharply since the low point of the 1958 recession. Plans for 1959 now show a 7% increase over 1958 for total capital investment. And the increase in expenditures for modernization is much sharper. Moreover, companies already have substantial plans for the years after 1959. New orders for industrial machinery, which are a good index of modernization plans, also are running well ahead of last year.

For the four-year period 1959-1962, manufacturing companies expect, on the average, to devote 65% of their plant and equipment outlays to modernization. This is the highest proportion reported in a McGraw-Hill survey since 1950. In dollar terms, manufacturing companies plan to spend $24.5 billion on modernization during the next four years.

This is an impressive figure, but it does not look so large when compared with the total need

*Excluding petroleum refining, which is reported as part of the oil industry in the data discussed in this editorial.

for modernization in manufacturing industries. As noted above, a previous McGraw-Hill study (conducted in August 1958) found that it would cost almost $35 billion to replace all the facilities that manufacturing companies then considered obsolete. Thus, present plans for modernization are enough to wipe out only 70% of the backlog of obsolete facilities by 1962—and this makes no allowance for the additional facilities that will be made obsolete by new machines and new processes introduced during the next four years. When these new developments are considered, present plans for spending may represent only half the job that will actually need to be done.

How To Accelerate

What can be done to accelerate the drive to modernize our industrial plant and equipment? Two of the greatest aids would be:

(1) Improve present provisions under the tax law for depreciation, to help industry retain more of the money it needs to carry out this massive job of modernization;

(2) Contain inflation, to preserve the purchasing power of the money industry sets aside to replace obsolete facilities.

At first glance, the supply of funds from depreciation allowances appears to be more than adequate. For manufacturing as a whole, depreciation allowances—the primary source of cash for modernization—will total $8.3 billion in 1959, compared with present modernization plans of $6.4 billion. Thus some extra funds will be available to support a further step-up in modernization in 1960.

Unfortunately, however, these depreciation funds are not evenly distributed from industry to industry, or from company to company. For example, in several of the metalworking industries, the prospective flow of cash from depreciation during the next four years is much less adequate than for manufacturing as a whole. These are industries with relatively large modernization backlogs, and they also are industries made up mostly of small or medium-size companies that have difficulty tapping the public money market.

As a result of these industry and company differences, there are many individual cases where shortages of funds limit the amounts of modernization now planned. In the McGraw-Hill survey, nearly half of all companies participating said that they would spend more on new plants and equipment if the depreciation allowances permitted by the tax law were increased substantially over the next few years. Most of these were relatively small companies. Their answers suggest that revision of the tax rules on depreciation should receive the most careful consideration as a spur to faster modernization.

The problem is complicated also by the threat of further increases in the national price level, which would necessarily include prices of capital goods. If "creeping inflation" resumes its march during the next four years, depreciation allowances based on present costs will be much less adequate for future needs. This points up the importance of national economic policies to maintain price stability. Unless this can be maintained, industry's dollars will not go far enough to do the modernization job that is needed.

Plan '59 Carries On

Industry's drive to modernize is now well underway. It can make a key contribution to our national strength and prosperity in 1959 and the years ahead. But the biggest part of this job is before us. It is up to the policy makers—in both business and government—to see that the job is done.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

Work-center foreman . . .
receives schedules for his group of machines on a punched card—one for each part to be machined. Card warns him when to expect an order and when the order must move to another work center

Punched cards turn short runs profitable

Here is a system that removes most of the obstacles to sure profit that plague short-run jobs. The system, developed at the Aluminum Taper Mill Div (El Segundo, Calif) of Altamil Corp, is set up around three basic elements:

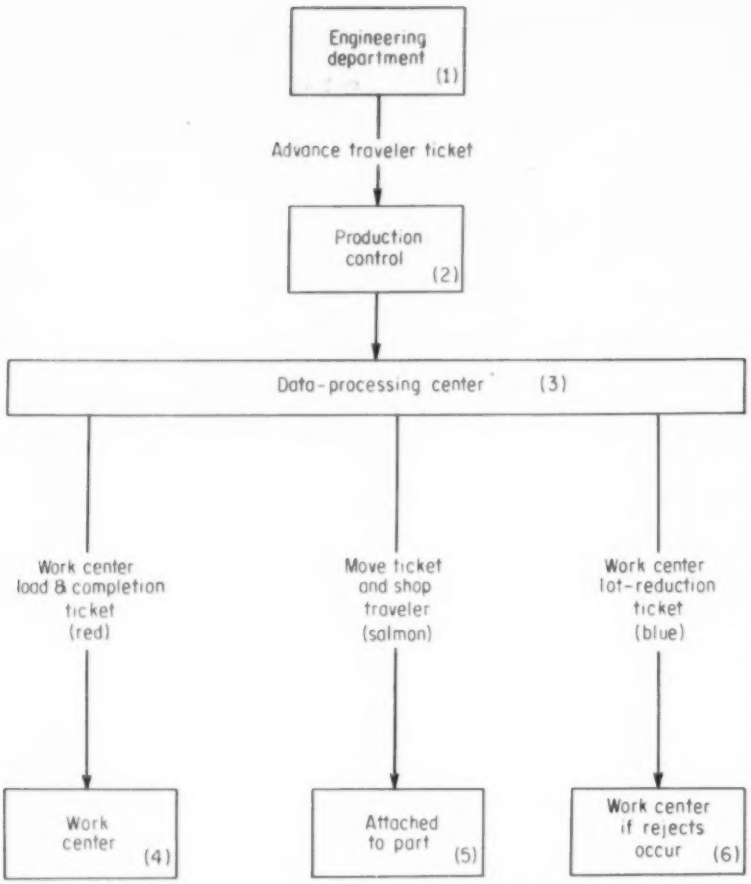
- **Machines grouped by work centers (groups of kindred machines)**
- **A master plan that schedules every machine operation**
- **Three punched cards that monitor production**

In any job shop, short runs often mean short profits. Nowhere is the problem more acute than in the subcontracting job shop that takes on machining of missile and aircraft parts. Here frequent engineering changes usually make short runs necessary, and profitable completion of a job depends upon getting maximum productivity from every man and every machine.

By riding herd on machining—from signing of a contract to shipment of completed parts—the plant avoids production bottlenecks and keeps its men and machines busy at all times. The secret is strict production control: pre-loading work centers, scheduling by punched card, and keeping tabs on every increment of labor expended on production of a part.

Advance planning is important and is closely linked to contract administration. Controllers are in on contracts while they're in the bid stage, thus can anticipate shop loads months in advance—often long before a contract's been signed. Alerted, master planners begin long-range forecasts of machine availability, pegged to the shop's work centers.

Contract or work order in hand, planners draw up a master manufacturing plan, a flexible production estimate based on the contract's delivery date. These estimates show how much time is needed for each step in the operation: design, tooling, advance planning, material procurement, and production of the first article or first-lot increment. All estimates come from the department concerned—from tooling and design, for example. Assembled and put into graphic form, they tell planners where a pre-production schedule must be shortened to put an item into production in time to meet delivery dates.


Engineering department (1)
Advance traveler ticket
Production control (2)
Data-processing center (3)
Work center load & completion ticket (red)
Move ticket and shop traveler (salmon)
Work center lot-reduction ticket (blue)
Work center (4)
Attached to part (5)
Work center if rejects occur (6)

Paperwork flow . . .
that controls production is shown in this simplified chart. For detailed description of what goes on in the numbered squares, see the corresponding numbers in the text

Daily job ticket . . .
filled out by each machinist in each work center, enables Production Control to coordinate planning estimates with actual performance. Data-processing center issues weekly reports that keep tab on each part in each order

Because careful planning is a necessity with short runs, preproduction scheduling is long-range and thorough at Altamil. In this phase, schedulers "load" machines some 90 days in advance of actual production. Later, this advance planning, reproduced on punched cards, will enable work centers to fulfill production requirements and meet delivery dates.

Production Paperwork

Paperwork is simplified but effective, and it reduces to a minimum the confusion that normally goes hand in hand with job-shop production. Here's how scheduling data are formulated and controlled, from preproduction to completion of the finished part (the chart on this page shows the data flow described in detail below):

(1) Engineering: Scheduling's prime document, called the Advance Traveler, originates in this department. The "traveler"—one of these forms is filled out for each part to be machined — routes the part through all work centers, estimating machine hours (not man hours) required to complete each operation (including setup time) within each center.

(2) Production Control: This department appends to the Advance Traveler an estimate of times required for material preparation, inplant moves, line inspection, and outside processing if any. Here work-center loading is scheduled in final form, and it is Production Control that keeps close tabs on work in process, knowing at all times the exact whereabouts of every part and every order.

(3) Data-Processing Center: Now the Advance Traveler for each part goes to Altamil's data-processing center, where Remington Rand punched-card machines service all four divisions of the corporation. From this basic document three production-control cards are punched. Routing of these three cards is Altamil's key to profitable short-run machining.

(4) Routing to Work Centers (red card): Once a job has been scheduled a red card, called the Work Center Load and Completion Ticket, goes to every work center which will work on the part. A kind of advance warning to work centers, this load ticket tells each work-center foreman that on a specific date (perhaps two months hence) so many parts will reach his department. It also warns him that on another specific date these parts must be machined and

ready to move to the next work center.

Typically, the red load card details the work-order number, the part number, how many parts are involved, and the "in" and "out" date for the work center. Suppose, for example, a part is scheduled to route through ten work centers. Ten separate red cards are punched, one for each machining center. One card, destined for work center 2, may tell its foreman that on December 1st he's to receive and begin work on twelve parts. The same card may specify that on December 5th these parts are to move to work center 3.

Meanwhile, the foreman at work center 3 has received a card warning that on December 5th he'll receive twelve parts from machine center 2, and that these parts must move to work center 4 on December 6th. Thus parts are routed, and foremen are alerted, all down the line. And when a work center completes its work on an order, the red Load and Completion card goes back to Production Control. In this way, Production Control knows daily the exact status of every part and every order. And when a red card returns from a work center, it effectively "unloads" the center and makes available machine time for future scheduling.

What the Work Center Load Card actually does is establish a production priority. The foreman may assign work to any machine within his department, may choose and load his own machines. But he must comply with the priority, he must be ready to work the order when the pieces arrive from another work center, and he must move the order on to the next center right on schedule. The significance here is that, although each foreman loads his own machines, work-center loading itself is scheduled from and by Production Control.

(5) Routing the Parts (salmon card): Second card punched at the data-processing center is called the Move Ticket and Shop Traveler. This salmon-colored card, its basic information punched from the master traveler, stays with each piece being machined. Often it's physically attached to parts—wing skins, stabilizers, spars—where possible.

This salmon card has several functions. First, it identifies each part by order, lot number, and customer. In this respect it is an identification tag.

This card also carries the part's routing. Machine-printed on its face are successive work centers through which the part must flow. Thirdly, the move ticket becomes an inspection card and quality-control record. No part may move until an inspector checks it and signs his approval, thus permitting the part to move to the next work center. And as a sign-off inspection card, the move ticket catches errors before they become costly and assures that labor isn't wasted on a part that has to be rejected, reviewed, or reworked. In many instances the plant has reduced labor on some parts by scores of hours, simply by catching rejects and stopping work early in the production cycle.

(6) Controlling Rejects (blue card): The third card punched from the original traveler master, the Work-Center Lot Reduction Ticket functions as a control device. This blue card warns work-center foremen that certain parts have been rejected, thus reducing the lot size listed on the red Work Center Load and Completion Ticket.

Suppose that one part in a twelve-part lot, scheduled to pass through ten work centers, is found to be defective at the second center, before the lot has been passed on to the third. The Lot Reduction Ticket, sent to all other work centers through which the lot must pass, warns foremen to expect only eleven parts. By telling foremen that one part has been rejected, this ticket eliminates split lots.

The program in action

Once the red and salmon cards have triggered production, the next phase of the program—Purchase Order Compliance—goes into action. Work centers, following instructions, machine orders on schedule, and Production Control oversees all activity.

It is when the unexpected happens that the program demonstrates its flexibility. Suppose that a piece is rejected. Immediately, the Lot Reduction (blue) Ticket warns Production Control that a substitute piece must be routed through work centers if the number of parts specified on the order is to be ready at the scheduled delivery date. Further, as a work center completes its phase of production, the red work-center-load card flows back to Production Control, pin-pointing the order's progress.

To supplement the three punched cards, and to provide closer control of present and future scheduling, the work centers also originate reports. Each machinist within a work center fills out a Daily Job Ticket, specifying the machine he's using and how much time he spent on the part. These job tickets flow to the data-processing center where, tabulated on the Remington Rand equipment, they assume the form of weekly reports that contain this data:

- Machine usage
- Work-center load
- Work-center labor
- Actual hours expended on the work order, compared to pre-planning's estimated work hours
- Labor overhead by work center, by part number, and by customer

Thus from the three punched production-control cards and the machinists' daily job tickets, company planners get weekly statistical reports that tell what work is in progress, what the shop load is, and how much labor has been expended to date on every order and every part.

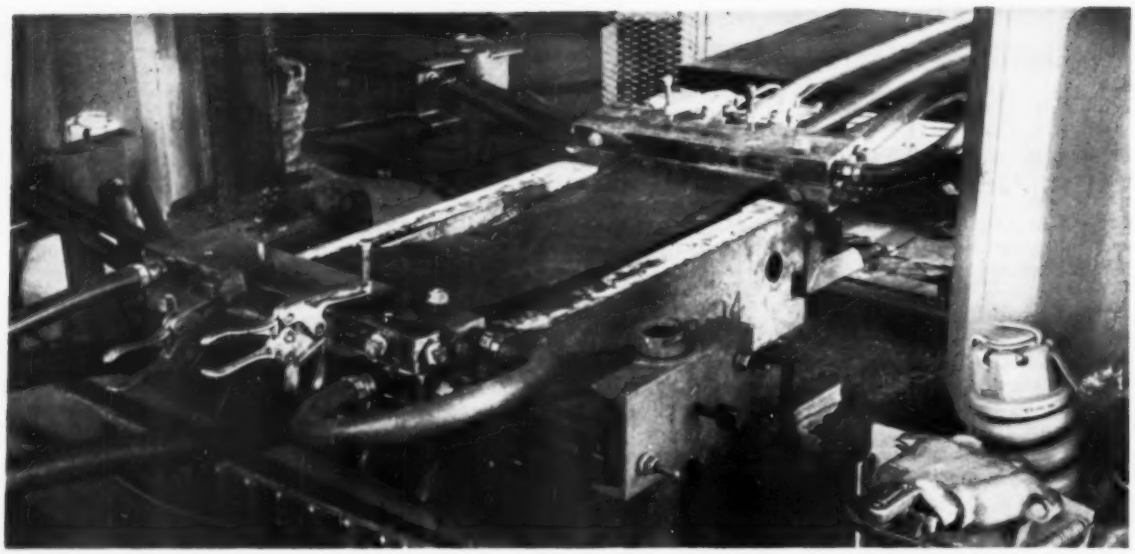
The first of these weekly tabulations details shop load. It evaluates the scheduled shop load, listed by due dates in each work center. It summarizes lot load currently released, affording a run-down of work in process by work center, customer, work order, lot number, part number, lot quantity, and estimated hours per work center.

Shop load is totaled for each work center. Completion due date shows all behind-schedule conditions. As lot releases are completed, the work-in-process file is unloaded and this report is purged of shop load hours.

Another weekly tabulated report, Job Status, shows labor to date and actual hours versus estimated hours by customer, part number, and work center. Thus a summary of actual labor hours, expended against each part as it routes through work centers, can be made and compared with estimated hours. Bid time and performance costs can be measured, and standards gaged and evaluated.

Still another weekly summary, the Labor Job Completion Report, becomes a measure of productivity. This report shows the final and total hours expended by work centers and part number for completed-lot releases, as compared to Engineering's estimated hours.

As Altamil's Eugene B Price, manager of contract administration and master planning, puts it, "We're able with this data to root out production bottlenecks. We can compare productivity every step of the way. Before us, neatly tabulated, is a detailed run-down of every job, long-run or short. We can more profitably plan the next run, can increase work-center loads for one productive phase and decrease them for another. In a word, we ride herd on machining and are able to turn short runs profitable."



Titanium is hot-formed . . .
in a Kirksite drop-hammer die. Portable Hufford resistance unit heats the work; water cooling prevents overheating at terminal contact areas. Current input is zero to 225 amps. Heat is checked with black-body target

HEAT and SPEED form latest titanium alloys

By George H DeGroat, associate editor

One-pass forming with no springback—and no restrike—is practical for new titanium aircraft and missile alloys if the forming is done hot. Convair Div, General Dynamics Corp, San Diego, is proving this technique with an extensive series of tests with special tools and experimental methods. So far, hot forming has been applied to skin and angle stretching, drop-hammer work, mechanical and hydraulic drawing, and joggling.

Most of the test tools are heated H R Mechanite cast iron, chosen for its high compressive strength (3-4 times its tensile value of 40,000 psi) and its resistance to grain growth after initial heating. Under a 2000-psi load, at 1200 F, grain growth is only about 0.27% in a thousand hours of application. Thermal conductivity is good—29 BTU/hr/sq ft/°F, compared to 11.4 for high-alloy cast steel. The material machines easily to close tolerances after heat treatment, and it has good elastic properties to withstand high service stresses when titanium is formed.

Mechanite dies finished to 75 mu in. have a coefficient of friction of 0.11, which permits deep draws with excellent surface finish on the work. To avoid pickup, the dies are lightly smoothed after working 20-30 pieces in most operations. A graphite solution of molybdenum disulphate is the lubricant, and an anti-galling material (Pyro-Plate) is applied to the die. To provide heat insulation between the die and the machine, a Marinite sheet with a density of 65 lb/cu ft is inserted.

Alloys worked

Three newly developed titanium alloys, which will maintain strength at temperatures up to 750 F, are being studied. These are Ti-2½ Al-16V, Ti-6Al-4V, and Ti-4Al-3Mo-IV. Stock thicknesses of 0.040, 0.060, 0.090, and 0.125 in. are being applied, with most tests on 0.040- and 0.060-in. stock. Most conclusive results are with Ti-4Al-3Mo-IV in the solution-heat-treated condition; it has been brake formed, angle stretch formed, roll flowed, skin stretch formed, joggled, drop hammered, drawn, and rolled.

Specific parts being made in this program, under an Air Force AMC contract, are canted fuselage-bulkhead assemblies, fuselage tail-cone assemblies, wing leading-edge air ducts, engine bleed air ducts, and stiffened panel components.

Heating is critical to get the work-pieces into the proper condition. Parts made of Ti-4Al-3Mo-IV can be formed without springback at 1100 F, but if this temperature is maintained too long, the physical properties of the material are damaged. Consequently, best results have been had with parts and operations that include only short forming cycles. In addition, temperature control must be within ±25 F, and a temperature gradient is established at the work by heating the die and conducting heat to the punch, where one is applied.

How heat is applied

Tools are heated by commercial electrical cartridge units—coiled resistance wire bound on a threaded refractory mandrel—whenever possible. The core and wire are embedded in a mass of magnesium oxide or a similar refractory, and encased in an Inconel sheath. The

units operate at relatively high temperature (1400 F) and high power densities. A portable power-control cart is available for each setup to control input to the electrically heated forming tools. This unit has individual control at each of six power outlets with individual thermocouples.

Materials are heated for processing by a portable 60-cycle, 200-kva Hufford resistance heater, controlled automatically by a radiation pyrometer and meter. For accurate results with the pyrometer, the work area to be measured is coated with a dispersion of molybdenum disulphide to produce a constant emissivity near black-body conditions. Another source of heat is a natural gas torch—applied when one part of the work requires more heat than another. Quartz lamps are also under investigation.

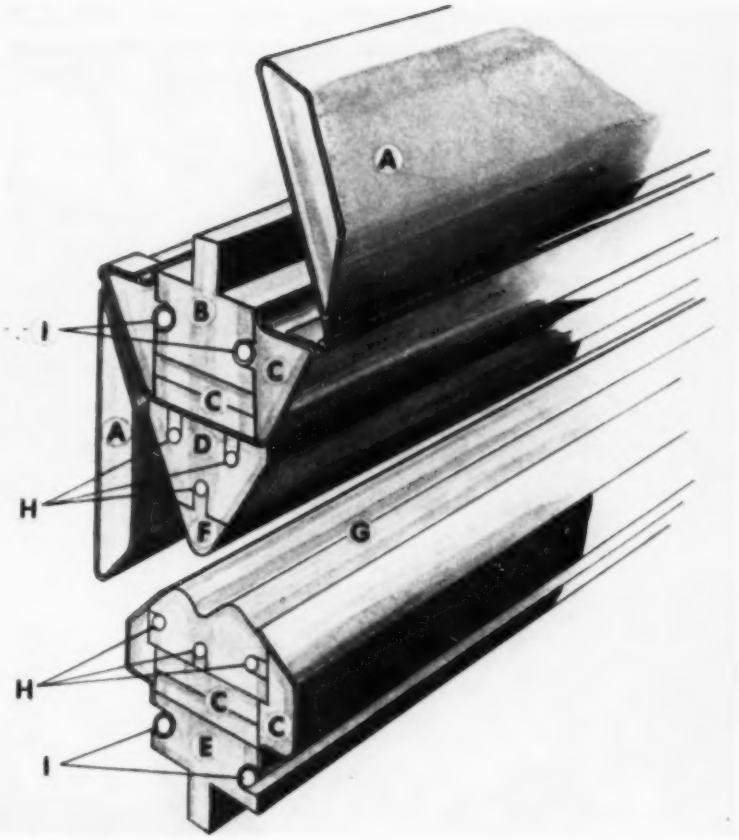
In drop-hammer operations, the work alone is heated to optimum forming temperatures by water-cooled resistance heating electrodes connected to the Hufford unit with two leads to each electrode. These are suspended at each end of the die by springs, and temperature of the work is controlled by a radiation pyrometer. Soaking time is less than two minutes, and the operation at 1125 F is fast—no more than one minute—so physical properties of the work material are not adversely affected.

Another fast operation is drawing with Meehanite dies. The punch, draw ring, and pressure plate are also Meehanite, and a Marinite insulation is applied between the die set and the draw ring as well as under the pressure plate. Temperatures up to 1400 F are supplied by 60 electric cartridge heaters in the draw ring and pressure plate. Actual working temperature is about 1125 F, and here again the draw is accomplished in less than one minute.

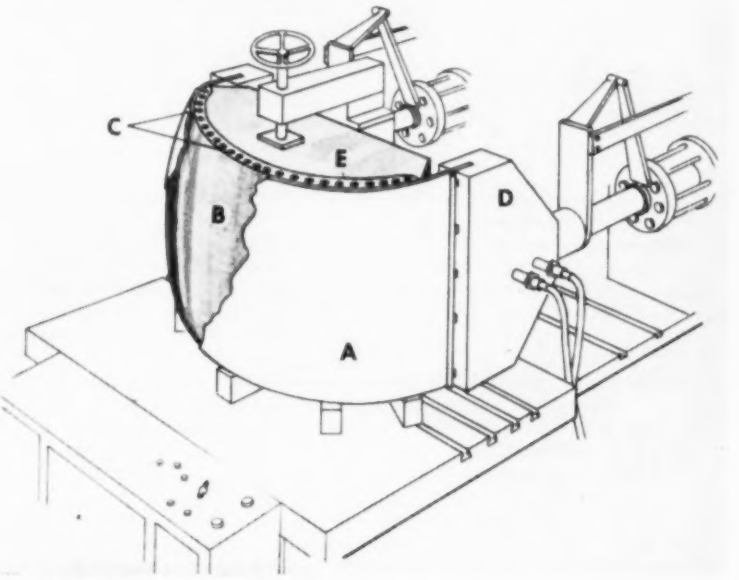
Slow forming

The slower operations are brake forming, angle stretch forming, skin stretch forming, and roll flowing. In brake forming, for example, the Meehanite punch and die each contain three tubular electric heaters capable of producing operating temperatures up to 1400 F. These tools are brought up to temperature by gradually advancing the heat control in 100 F increments to allow even heating and thus prevent distortion.

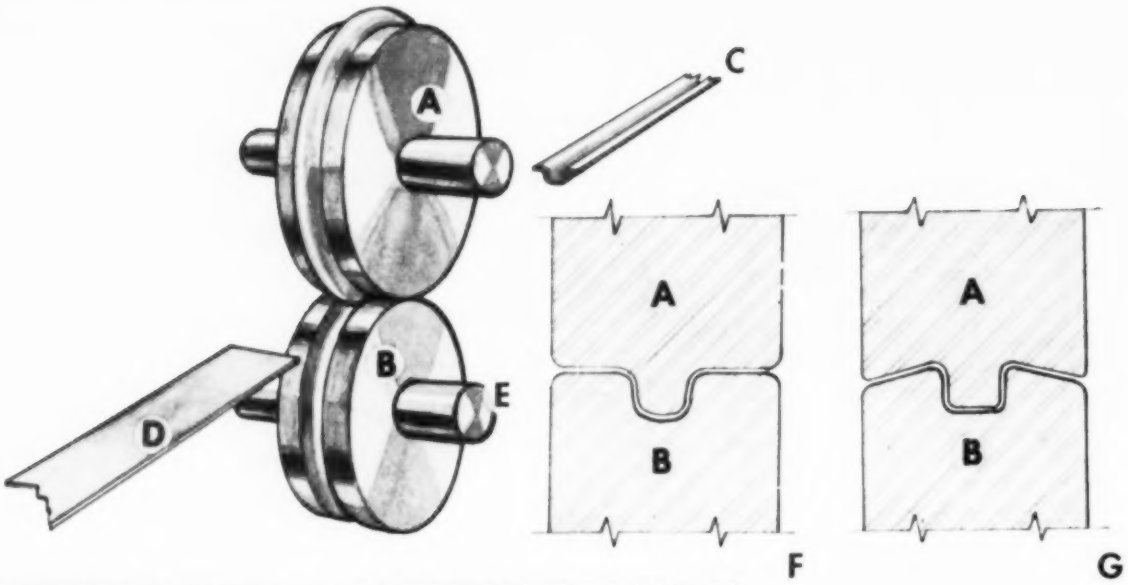
It takes 30 min to heat Meehanite dies for angle stretch forming at

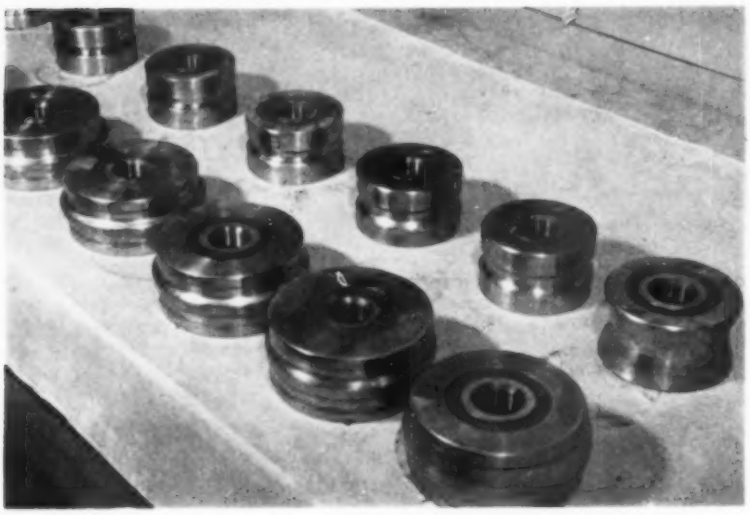


Interchangeable brake-die inserts . . .
hot form stock of various thicknesses. Steel punch holder (B) is insulated (C) and equipped with water cooling tubes (I). Insulated cover (A) reduces heat losses. Punch assembly (D & F) has heater elements (H). Die (G) and die holder (E) are similar



Hot die for skin stretch forming . . .
is Meehanite (B) with a compound 3-in. crown over 18 x 22-in. face. Die is backed by refractory insulation (C) poured into place. Work (A) is gripped by clamps (D)





Hat-section rolls . . . hot-form titanium strip into standard contours at 1125 F. Rolls are high-chrome tool steel, heated by gas and controlled by pyrometer. Work is resistance heated. Top rolls (A) force work (D) into bottom rolls (B). Seven roll sets in photo are progressive

1250 F. There are 55 electric cartridge heaters in these tools to supply operating temperatures up to 1400 F. Skin stretch forming tools are equipped with 44 such heaters for the same purpose.

Roll flowing

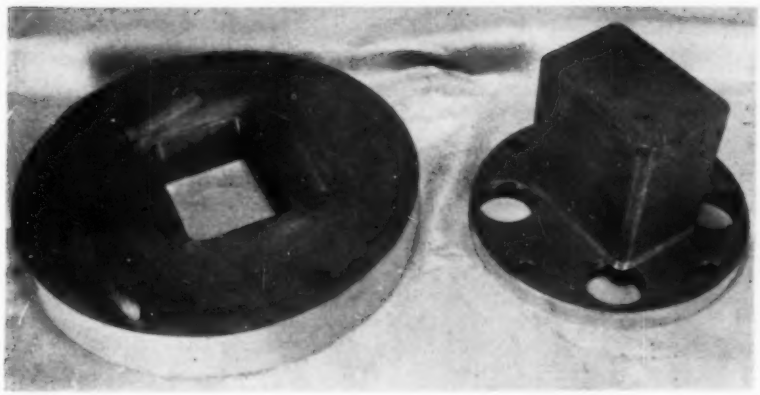
In roll flowing, operating temperatures are achieved by preheating the work in an oven and then applying a gas flame directly during the forming operation to maintain temperature in outer part of the blank. Temperature of the work is controlled by a pyrometer. With the application of heat, the forming operation reduces the diameter of the blank—a principle of spinning rather than roll-flowing.

From roll-flowing tests it has been established that a drawn preform is needed for parts formed to an included angle of less than 40°. The half angle (20° from the machine centerline) to a point on the periphery of the part is the limiting factor. Also, there must be a flat or preformed area in the center of each part. This should be larger than ½ in. for tailstock ram pressure.

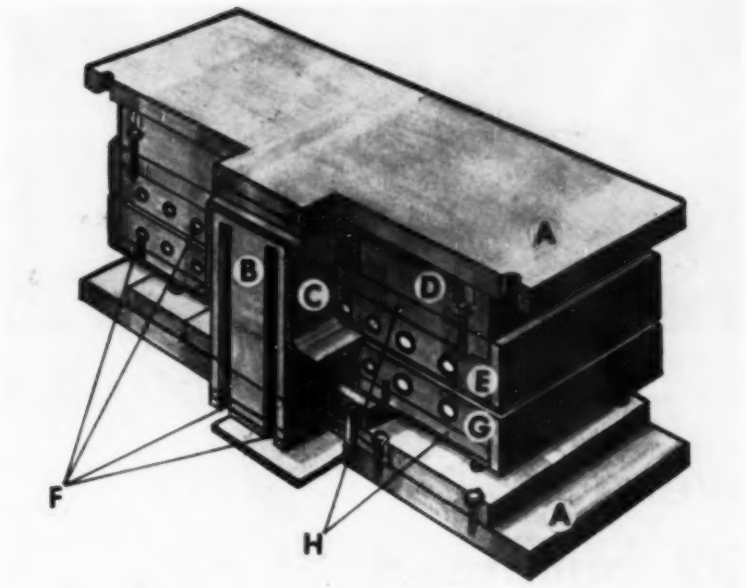
A feed rate of about 2 ipm and a spindle speed of around 300 rpm has been found to be a safe way to start previously untried roll-flowing operations—especially when less than a 70% reduction is produced on blanks less than ⅛ in. thick. Where the material is very brittle, a feed rate of less than 1 ipm provides an opportunity to see the reaction of the blank to the roll pressure. Allowances for machine deflection are important and are usually determined by trial and error for each material.

Speed works best

In general, results with these slower operations have not been as good as those obtained in setups where hot forming is fast. To avoid damage to physical properties, it may be necessary to develop a different heat treat prior to forming or, by some other means, condition the material so it can be held at high temperatures for relatively long periods without adverse effects. Of course, conditions vary with the different alloys, and these results per-



Draw die and punch . . .
form titanium pans 4 x 6 in. by 4 in. deep. Operating temperature is 1400 F, produced by electric cartridge heaters

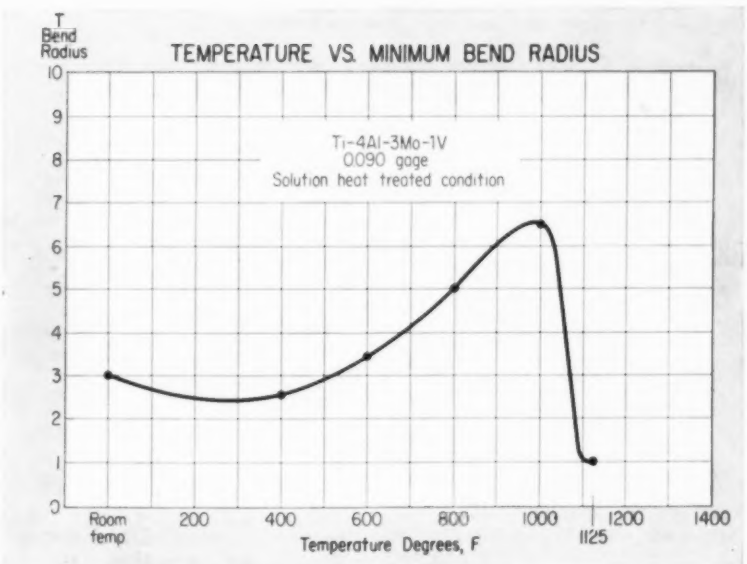


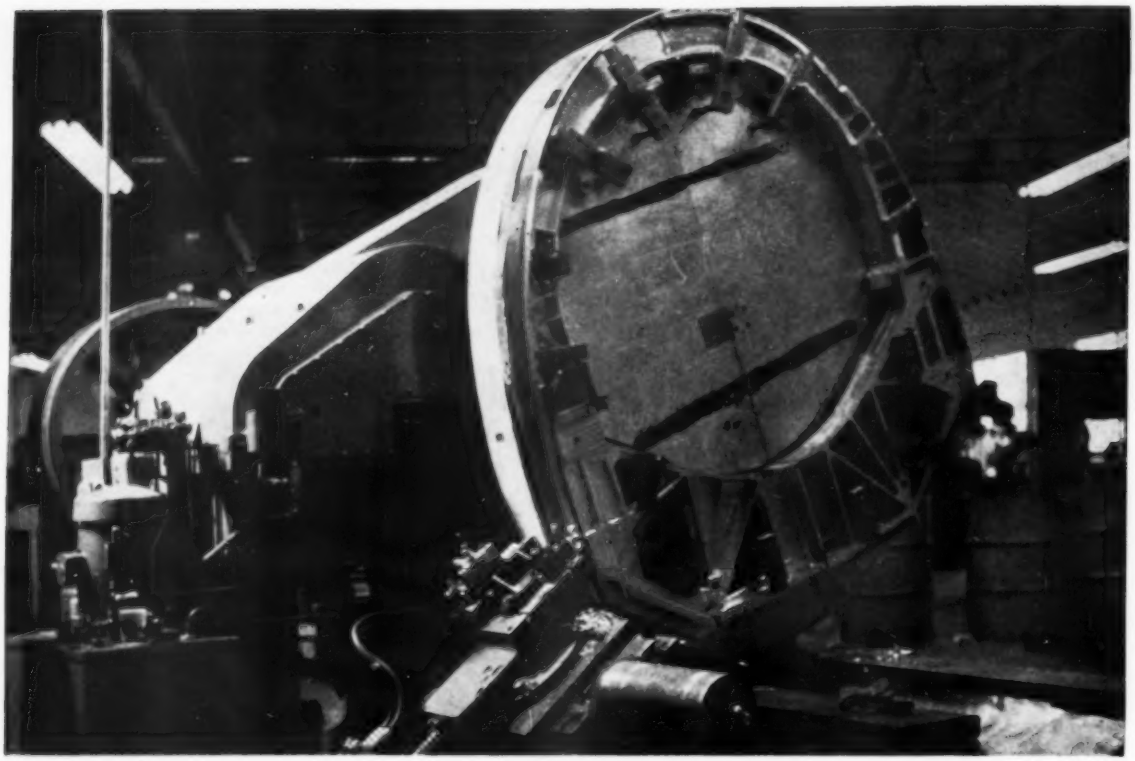
Mechanical draw die . . .
can be set up with several punches and draw rings with various radii and clearances for sheets of various thicknesses. Bolster plates (A) retain die members (D & E) and punch members (B & G). Stock (C) is formed with heat from inserts (F). Insulation (H) reduces loss

Minimum bend radius . . .
is found at 1125 F, where a radius equal to material thickness can be formed. Variations in the minimum point are caused by alloy content and shape and size of work

tain only to the alloy currently being hot formed.

In the faster operations—joggling, rolling, drawing, and drop-hammer forming—no difficulties have been encountered. Springback has been eliminated, and finish size is achieved without restrikes so only one set of tools is needed for any operation. Besides shortening the time required for tooling up a job—and cutting tool costs—it is expected that the program will result in better parts and at the same time eliminate hand forming operations and stress relieving. According to F A Monaham, manager of manufacturing, the program will be extended to include additional titanium alloys in the future.





Converted lathe . . .
swings a peripheral model to which is clamped an aircraft bulkhead being turned. Surplus gun lathe has 70-in. faceplate and hydraulic carriage on angular ways

Hydraulic conversion turns this F-102 bulkhead

By W N Engel, chief engineer, H & B American Machine Co

Tracer follows model (left) . . .
and tool cuts work within ±0.005 in. of model dimensions. Cam control keeps tool cutting at constant surface speed at an average 3 rpm

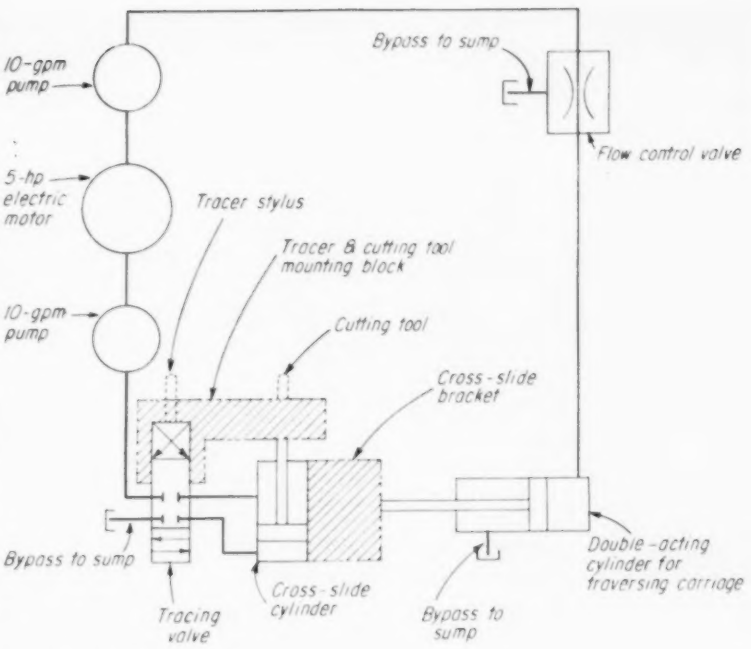
We combined a surplus Navy gun lathe, a tracing attachment, and hydraulic power to make a bulkhead-contouring lathe for Convair. The machine does accurate and intricate contouring on outer flange faces that have constantly changing radii and frequently changing angular relations to the work centerline. The rebuilt machine holds tolerances of ±0.005 in., can move the cross-slide at 200 ipm maximum, and will reproduce corner radii as tight as 0.06 in.

All that's actually left of the original gun lathe is the headstock and the forward section of the bed. To this has been added a True-Trace tracer valve control, a hydraulic carriage on angular ways in front of the bed, and a 70-in. faceplate that

mounts on the 30-in. spindle nose of the original machine. The reworked machine does roughing and finishing on F-102 bulkheads and similar large-diameter parts that require contouring.

These contours are taken from a full-size 3-D model that clamps to the faceplate—then the work clamps to the model. A cross-feed hydraulic cylinder traverses the carriage across the angular ways at any required speed, controlled by a flow valve. The tracer-valve stylus rides against the model to control simultaneous in-out motion of the cross-slide and toolblock. The single-point tool produces surfaces that require minimum hand finishing, and it allows tight corners when required.

The original lathe drive was a 5-hp 1750-rpm motor with herringbone-gear reduction to 3 rpm at the headstock. This has been replaced with an adjustable-speed motor that is cam-controlled according to radius and slope of the work to provide constant cutting speed. The tracer is direct- and instant-acting, so the model is made to the exact 3-D contour required on the work.



Hydraulic circuit . . .
has two pumps that move cross-slide and carriage traverse. True-Trace valve on the cross-slide controls contouring motions

$100,000 facility chemical-mills JetStar wings

The Southeast's largest chemical milling facility (Cost: $100,000) will go to work late this summer milling 30-foot wings for the Lockheed JetStar, which will go into production at Lockheed Aircraft Corp's Marietta, Ga, Division sometime this fall.

With Lockheed-Marietta's setup thickness of wing panels can be tapered from ¼ in. at one end to paper-thin tolerances on the other, as etching chemicals eat away surplus metals in areas that are ordinarily inaccessible to mechanical milling methods.

Three-tank process

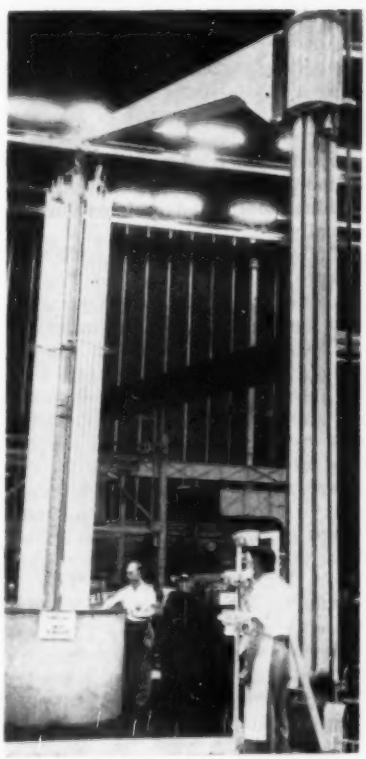
Chem-Mill (a process developed by North American Aviation and now marketed by that company's agent, Turco Products Inc) consists of three tanks—one of stainless steel and two of carbon steel lined with glass insulation. The tanks, 30 feet deep and five feet in diameter, contain agitators, pumps and heating coils for controlling chemical action.

An electrically driven hoist about 40 feet high (see photo at right) lowers parts into the first tank, which is filled with sodium hydroxide heated to 190 F. This caustic agent etches at a rate of 1/1000th of an inch per minute. The rate of shaving off of surplus metal is automatically controlled by the speed of immersion and withdrawal from the etching tank.

Automatic shutoff

The part is next dipped into a tank of room-temperature flowing water. Then it goes into a chromic acid solution (air-agitated at room temperature), which removes smut from the part. Lockheed's installation is considered particularly safe because the entire milling plant shuts down if any part of it breaks.

Lockheed at the moment is confining its chemical milling to aluminum alloys, but research is underway at Marietta on a pilot plant for chem-milling of stainless steel, titanium and other hard metals that may one day be used in construction of the B-70 "Valkyrie" chemical bomber.



Electric hoist . . .
. . . handles 30-ft wing panels at Lockheed Aircraft Corp's Marietta, Ga, plant, transferring them from one tank to the next. The hoist is about 40 feet high

Hand assembly, rather than automation, is predominant in manufacture of Toyota Group automobiles

Less than 5% automated, primitive by U S standards, Japan's fast-expanding Toyota Group is nevertheless the prime reason why...

Japan eyes U S small car market

Production of 300 to 400 cars and trucks a day is pretty small potatoes by Detroit standards but to Japan's infant auto industry it's phenomenal, especially when you consider that the job is done mostly on antiquated machine tools and automation is virtually nil.

Yet this same output of 300-400 vehicles a day has put the Toyota Group, a combination of eight separate but interlocking companies in the Nagoya area, smack on top of Japan's postwar industrial heap, and it has enabled Toyota to corner about half of the entire Japanese domestic auto market with a sleek, U S-style passenger car.

Not only that, Toyota is pinning its future hopes on cornering a share of the U S small car market, has already launched a selling campaign on the West Coast. So far, Toyota through its sales organization, Toyota Motor Car Trading Co, has managed to export about a thousand cars to the United States, this year hopes to triple that number—even though America's Big Three will enter the field within the next few months.

The Toyota Group produces two passenger cars, the Toyopet and the smaller Corona, along with trucks for Japan's domestic market and for U S Armed Forces Special Procurement. Star of the stable is the Toyopet, which has a very American look, is bigger than the foreign best sellers in the U S—the Volkswagen and Renault Dauphine.

Ruggedly built

Ruggedness is its big selling point. The Toyopet is designed to withstand the gruelling potholes of Japan's streets and roads, to say nothing of the jockeying of Japanese "kamikaze" cabdrivers. For this reason, the 58-hp, four-cylinder car has a weight-power ratio of something like 30:1—just about double that of most U S and European small cars. Just how well such a car will do on the high-speed superhighways and turnpikes of America has Toyota engineers a little worried.

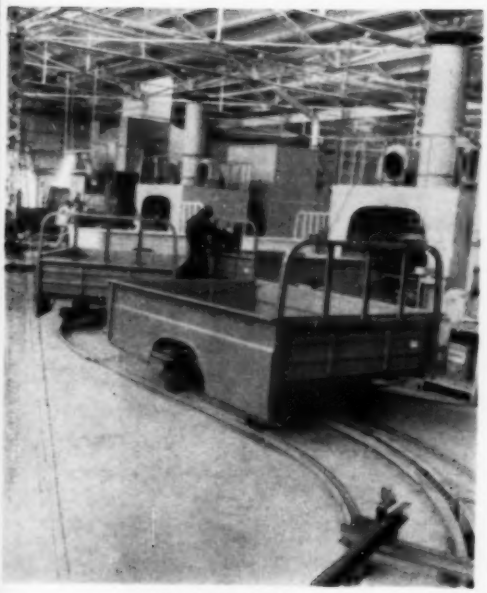
Some parts of the Toyopet are heavy simply because of Toyota's antiquated-by-U S-standards production methods. For example, casting is not as precise as in the United States, according to one official: "We can now do what you do in the U S, but we haven't in the past."

Toyota salesmen know that they must overcome this problem if they are to compete with small European cars for the U S market. Oddly enough, Sales Company President Shotaro Kamiya doesn't think the entry of the U S Big Three into the small car market will hurt Toyota. Rather, he believes it will actually broaden the market.

Toyota now plans to put out two new cars. One will be a small car beamed at the American market and is expected to be ready for export this fall. The other is the long-awaited "People's Car."

Aim for Eastern market, too

The latter has the support of the Japanese government, which hopes to see such a car developed for all of Asia's markets. Trouble is, no one at Toyota, or anywhere else in Japan for that matter, has been able to come up with anything that could sell for less than $1200—a big price



Webb chain belt . . .
. . . the first installed in Japan, is one of several at Toyota Body Co. Webb belts are now being produced under license in Japan by Sumitomo Metals Co

in a country where the average wage is still only about $35 a month.

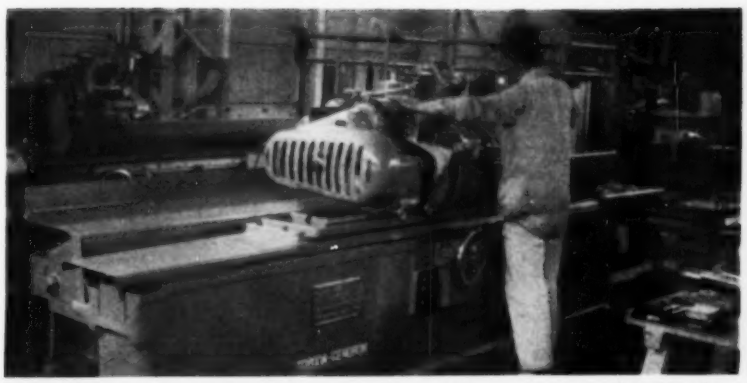
Aiming in that direction, Toyota last year tried to bring out a smaller version of the Toyopet, the Corona. It was a dud. Designed to be sold in competition with Nissan Motors' Datsun, the Corona was a bastardized combination of Toyopet body and pickup truck chassis.

Japanese like chrome, too

It failed to appeal to Japanese car buyers who, like Americans when given the choice, always go for more chrome and more gadgets. Furthermore, the small truck engine was too noisy, used too much oil, and was never adequately adapted for high speeds.

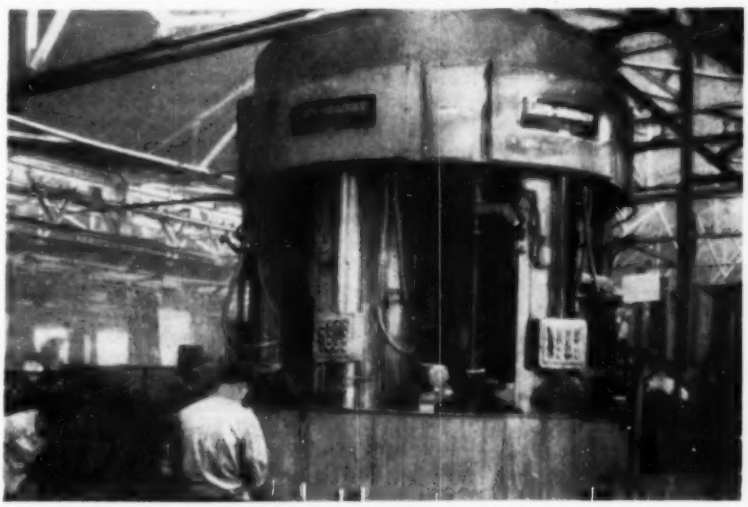
Inadequate R & D

Even though the Toyota Group is today one of Japan's richest industrial combines, its research and design efforts are still pretty sketchy. One reason for this is that Toyota, unlike several other Japanese manufacturers (Nissan and Austin, Hino and Renault, Isuzu and Rootes) has no overall licensing and technical assistance agreement with any foreign manufacturer. Ford was interested in such an agreement a few years ago but negotiations floundered. But Toyota, having made the



Toyota Group's newest and best machine tools range from this Gendron (French) cyclindrical borer made by Toyota Koki, its machine tool subsidiary, to . . .

. . . a U S-made Giddings & Lewis horizontal bar machine and a . . .



. . . modern Lees-Bradner six-station hobber

grade alone with some help from the Korean War boom and from U S Special Procurement (this year about 10% of Toyota's production) is no longer interested in foreign capital participation.

An American automaker, or even a European one, might be shocked at the Nagoya plants of Toyota Auto Co, Toyota Auto Body Co, Toyota Koki (machine tools) and other subsidiaries. For although the end-product compares favorably with many a Western-made auto and Toyota's production line bears a striking resemblance to smaller lines in the West, methods are sometimes terribly antiquated by Western standards.

Few transfer machines

For instance, only a small percentage of automotive parts assembly is done with transfer machines—maybe less than 5% as compared with 100% in most U S and European operations. Steering gear boxes, some cylinder block parts, and universal-joint "spiders" are the principal parts now produced by automated machines.

But Toyota now plans to automate production of cylinder blocks, ignition cases, transfer cases, differential cases and such common components as yokes. Toyota Koki, the Group's machine tool manufacturing subsidiary, will build some of the equipment. But the Group has no plans for employing numerically controlled machine tools, nor does it see any such need arising in the immediate future.

20% US-made machine tools

Machine tools in the main plant and in the body plant are about 20% of U S manufacture, 10% European and the rest made in Japan. Some of the U S machinery is 30 to 40 years old, was purchased second-hand in the States.

Except for some German gear-cutting machinery and a few small Swiss jig borers, almost all of the machinery imported by Toyota has come from the U S, and about $1 million worth of machine tools (mostly gear-cutting machinery) is now on order in the United States.

Toyota's No. 1 problem today is replacement of obsolete machinery. The company has no exact plan or schedule for such replacement, because much will depend upon design factors over the next few years. But emphasis will be placed on speeding up all processes, and new machines will be needed for the job.

Japanese presses in line at Toyota are patterned on U S models

As it is, Toyota Koki, the group's machine-tool manufacturing element, is one of the Big Five in that industry. This firm devotes about half of its output to production of parts for the motor company, the other half of its output to machine tools. About a third of its machine tools go to Toyota Group companies, the other two-thirds to Japanese machinery producers, including some other automobile manufacturers.

The company produces cylindrical boring machines under a licensing arrangement with Gendron Freres of France, and has a casting license agreement with U S's Meehanite.

At present the machine tool company is making differential cases, rear-axle assemblies, cylinder blocks and universal joint "spiders" for the auto company. Because such components require special manufacturing techniques, especially for export models, they are made by Toyota Koki instead of one of the other subsidiaries.

An official of Toyota Koki says that the company has been studying numerical control of machine tools, has even built an experimental milling machine based on a pulse technique. But it is not now manufacturing any such machinery, nor does it plan to do so in the near future.

Biggest problem in the machine tool company is promoting higher standards of accuracy, but officials believe Toyota Koki's Gendron-designed machines are as good as those produced in the French company's plant, although the production line in the Japanese plant is somewhat longer.

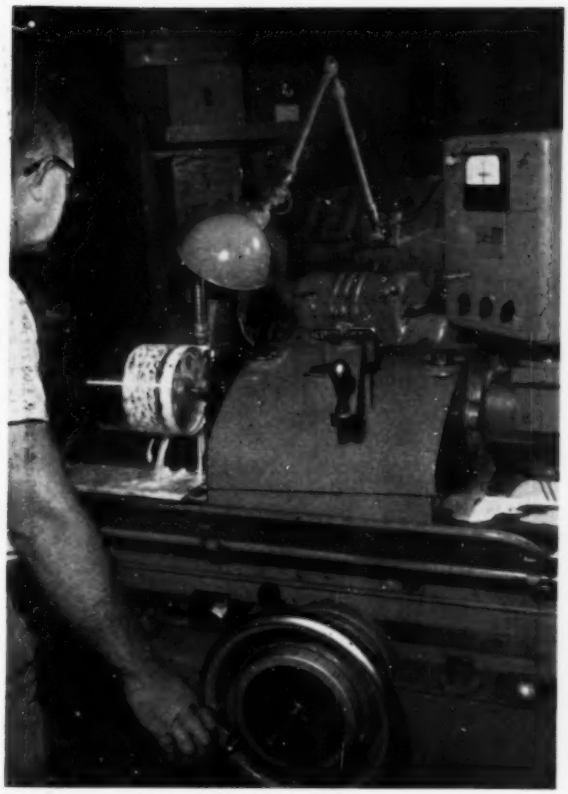
The company expects demands for its machines to rise from both Toyota Group member companies and from outside firms. So far, export orders have consisted of one order for a Gendron grinder from a Brazilian company.

Volkswagen spending to hit new high

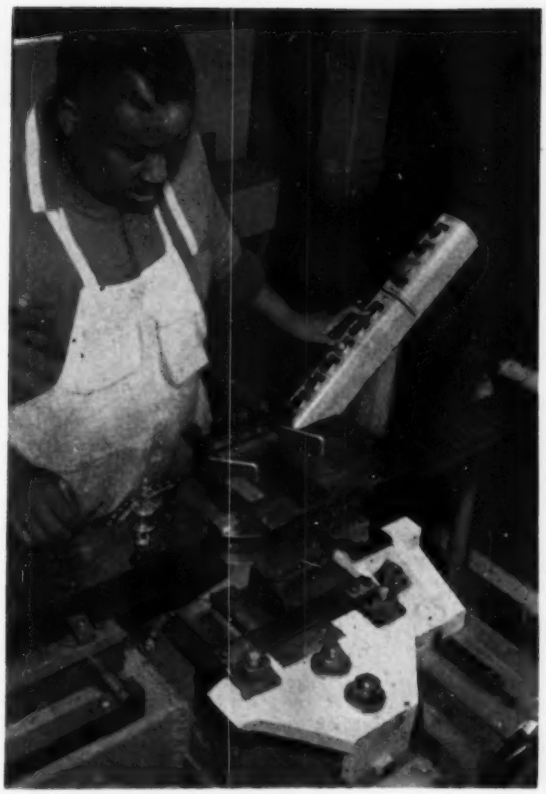
Germany's Volkswagen plans to spend $120 million on new plant and equipment this year, marking a new high in capital spending—not only for Volkswagen but for any German industry. Volkswagen's 1958 investments amounted to $64 million, bringing its total postwar outlay to $261.5 million.

The new investment is expected to increase the company's daily production capacity from 2295 vehicles (the 1958 figure) to more than 3000 by the end of this year. Output for 1959 is expected to reach 665,000 vehicles—112,000 more units than last year.

Of Volkswagen's total 1958 exports, 42% went to Europe, 40.2% to the US, the rest to Africa, Australia and Asia.



Roundness within 0.000,02 in TIR . . .
. . . is required in grinding this copper-plated memory drum cylinder. Finish must be within 4 to 8 micro-inches. This Cincinnati machine grinds aluminum surfaces, hardened-steel journal diameters (0.590 in.) and a copper-plated surface of 6.625-in. dia with 8 in. overall length



Bends from ⅜ to 3-in. diameter . . .
. . . and from 10 to 115 degrees on either plane are possible in wave guides made on this modified Pines machine. Conversion from bending round to rectangular wave guide tube is accomplished with radius dies, joggle dies, and with special laminated mandrels

It's precision plus quantity output at Hughes-El Segundo as...

Special setups split tenths

Tolerances as tight as 0.000,05 in. are being held in production at Hughes Aircraft Co's El Segundo, Calif, plant where ultra-precise parts for airborne electronic systems are being turned out in quantity. Special machines do such jobs as grinding gears from hardened blanks, bending wave guide tubing, and grinding OD's of memory drums—all to tight tolerances.

Such stress on precision in manufacturing is a vital part of the reliability of an electronic assembly when it is airborne. For instance, one of the systems turned out by Hughes-El Segundo is an electronic armament control which automatically detects a target and guides a jet plane to it. Then there's another Hughes-produced system, Digitair, an airborne computer which enables interceptors to fly a completely automatic combat mission—from takeoff to touchdown—leaving the pilot free to make the tactical decisions needed in combat.

Memory drum cylinders for such computer setups are ground on a 14 x 36 Cincinnati grinder, built specifically for the job and equipped with an electronic taper gage.

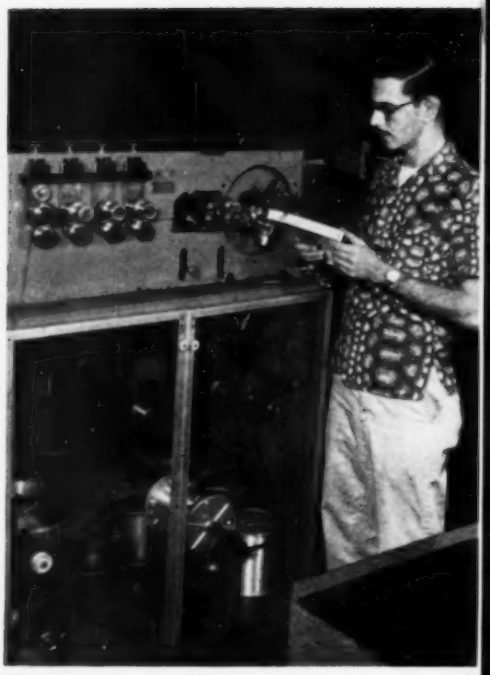
With this device, taper adjustments of 0.000,05 in. per foot can be made on the table. Hydraulic and coolant systems are temperature controlled to hold diameter tolerances of 0.000,-05 in. and concentricity of 0.0001 in. A special coolant filtering system permits finishes of 4 micro-inches rms. Variable-speed motors drive the machine's wheel and work heads.

Before grinding begins in this setup, however, aluminum cylinders are copper plated, and hardened-steel journals are ground to a total OD tolerance of 0.000,15 in. Concentricity between this diameter and the journals is held to 0.0002 in. TIR during grinding of the copper-plated periphery.

No measuring devices are permitted to contact the finish-ground copper OD, which has a surface finish of 4 to 8 micro-inches rms. Final measurements are made prior to a depth-controlled finish pass with electronic and other special gages.

Another special machine in use at Hughes is a fine pitch gear grinder built by Sheffield Corp. Purpose of this setup is to make precision gears directly from heat-treated stainless

Hardened blanks become precision gears . . .
. . . in this special Sheffield fine-pitch gear grinder, developed especially for Hughes to hold size tolerances of 0.0002 in. in AGMA class 3 precision gears. The machine will grind gears of 16 to 96 dp with 4 to 192 teeth and an overall length of 15 inches between centers



Flexible wave guides . . .
. . . are made on this Hughes-built machine, which forms soft brass ribbon, winds it into a convolute tube, and lays solder into the tubing for later brazing

steel blanks. Design requirements for MA-1 armament control system gear boxes specified stainless gears of AGMA class 2 and class 3 precision, which permit total composite errors of 0.0005 and 0.000,25-in. respectively. Diametral pitches of the gears range from 32 to 96 in 11-tooth enlarged pinions to 150-tooth gears. Hardness runs 55 to 60, Rockwell C.

Because of heat treat distortion and shrinkage, it was virtually impossible to cut and finish shave gears before heat treatment and meet precision requirements on a production basis. Consequently, the Sheffield grinder was bought to permit finish cutting after heat treatment. Hughes then designed special tooling to accommodate individual gear blank designs.

Hobbing principle

Basically, the principle of operation is the same as that of a gear hobber, except that a grinding wheel is substituted for the conventional hob. The work is continuously rotated at a fixed rate in relation to the rotation of the wheel, which generates the gear tooth from a basic rack of the desired pitch—crush-formed on its periphery as a continuous helix. To develop the gear tooth form over the entire workface, the blank is fed upward past the horizontal centerline of the wheel.

New bending method

Another new technique, for bending of wave guide tubes, involves a standard Pines Engineering Co machine modified by a special shim-injecting device that pushes flexible shims into tubing. Special radius and forming dies permit bends in either plane, and at any radius from 10 to 115 degrees. Joggle dies allow a push method of more than one joggle at a time, so that both brass and aluminum wave guides can be handled with the same tooling. This continuous bend technique, incidentally, is a great improvement over former methods.

Flexible (or semi-rigid) wave guides are also made on special equipment at El Segundo, where Hughes engineers have developed a number of machines to form and wind both brass and stainless steel flexible wave guides.

One such machine has four sets of matched forming rolls arranged in tandem. Raw material fed into the machine is 0.003-in.-thick dead soft brass ribbon. Width of this ribbon depends upon the application, mandrel size, and the number of convolutions. Dead soft aluminum wire and soft solder are also delivered to the machine.

The soft ribbon is pulled through each set of rolls for progressive forming until it reaches a mandrel. At this point, the ribbon has also picked up the aluminum wire and solder. As the ribbon is wound over the mandrel, two sets of interlock rolls engage it, producing one continuous rectangular tube, cut to length.

The tubes are then placed on soldering mandrels for furnace brazing. After the tubes are removed from the furnace, and cooled, the aluminum wire is removed, resulting in a convolute tube that can be bent to the shape required for connecting various micro-wave assemblies together. With this flexibility the tube is strong enough to withstand airframe vibration, according to Hughes-El Segundo production people.

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American Machinist

REFERENCE BOOK SHEET

Blank Diameters for Round Shells – VII

Ferenc Kuchta, mechanical engineer, J Wiss & Sons Co, Newark, N J

Surface Areas:

$$I - \pi d_1 h_1 + \pi d_3 h_2 + \frac{\pi(d_3^2 - d_2^2)}{4}$$

$$II - \pi d_4 h_3$$

$$III - \frac{\pi f(d_6 + d_5)}{2}$$

$$\frac{D^2\pi}{4} = \pi d_1 h_1 + \pi d_3 h_2 + \frac{\pi(d_3^2 - d_2^2)}{4} + \pi d_4 h_3 + \frac{\pi f(d_6 + d_5)}{2}$$

$$D = \sqrt{4(d_1 h_1 + d_3 h_2 + d_4 h_3) + 2f(d_6 + d_5) + d_3^2 - d_2^2}$$

75

Surface Areas:

$$I - \pi d_3 h_5 + \frac{\pi(d_4^2 - d_3^2)}{4}$$

$$II - \pi^2 R d_1 + \frac{\pi(d_1^2 - d_3^2)}{4} + \pi d_2 h_3$$

$$III - \pi d_1 h_1 + \frac{d_1^2 \pi}{4}$$

$$\frac{D^2\pi}{4} = \frac{d_1^2\pi}{4} + \pi d_1 h_1 + \pi^2 R d_1 + \pi d_2 h_3 + \frac{\pi(d_1^2 - d_3^2)}{4} + \pi d_3 h_5 + \frac{\pi(d_4^2 - d_3^2)}{4}$$

$$D^2 = d_1^2 + 4(d_1 h_1 + d_2 h_3 + d_3 h_5 + \pi R d_1) + (d_1^2 - d_3^2) + (d_4^2 - d_3^2)$$

$$D = \sqrt{d_1^2 + 4(d_1 h_1 + d_2 h_3 + d_3 h_5 + \pi R d_1) + (d_1^2 - d_3^2) + (d_4^2 - d_3^2)}$$

74

Bridgeport Ultra Fine Grain Brass puts more allure in a lure ...and more profit in your product!

Clear, polished or painted, "Dardevle" fishing lures, made by Lou J. Eppinger Mfg. Co., Detroit, Mich., are world famous for their deadly, sure-fire allure.

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In Eppinger's case, for instance, some of the lures are clear polished and lacquered. Others are hand-painted. Ordinarily, these two different operations would call for two different types of metal. But, by using Bridgeport Ultra Fine Grain Brass, the same material can be used for either finish, an important purchasing saving.

If you're fishing for ideas on how to reduce your strip metal finishing costs, cast a line in Bridgeport's direction. Call your nearby Bridgeport Sales Office . . . or write direct for a copy of our Ultra Fine Grain Brass booklet, GRAIN SIZE, THE FOURTH DIMENSION. Dept. 3008.

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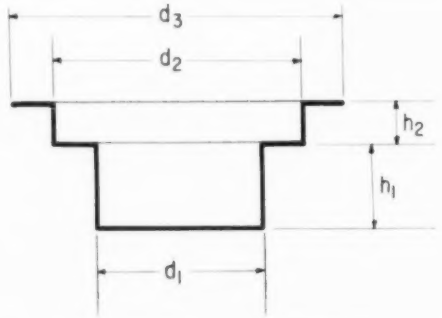
Blank Diameters for Round Shells — VIII

Method of Calculation: Shells 4, 23 and 29 (AM–June 15' 59, p145)

4

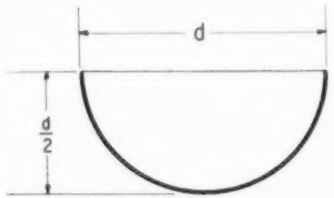


$d_1 = 2"$
$d_2 = 3"$
$d_3 = 4"$
$h_1 = 1"$
$h_2 = 0.5"$

$$D=\sqrt{d_3^2+4(d_1h_1+d_2h_2)} = \sqrt{16+4(2+1.5)} = \sqrt{30} = 5.477$$

Blank dia. = Approx. 5.477"

29

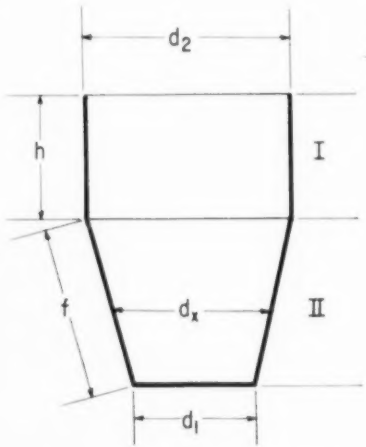


$d=3"$

$$D=\sqrt{2d^2} = 1.414d = (1.414)(3) = 4.242$$

Blank dia. = Approx. 4.242"

23



Surface Areas:

$I = \pi \cdot d_2 \cdot h$

$II = \pi f\left(\frac{d_1+d_2}{2}\right)+d_1^2 \cdot \frac{\pi}{4}$

Where $\frac{d_1+d_2}{2}=d_x$

$= \pi f\, d_x + d_1^2 \cdot \frac{\pi}{4}$

Blank dia. D = ?

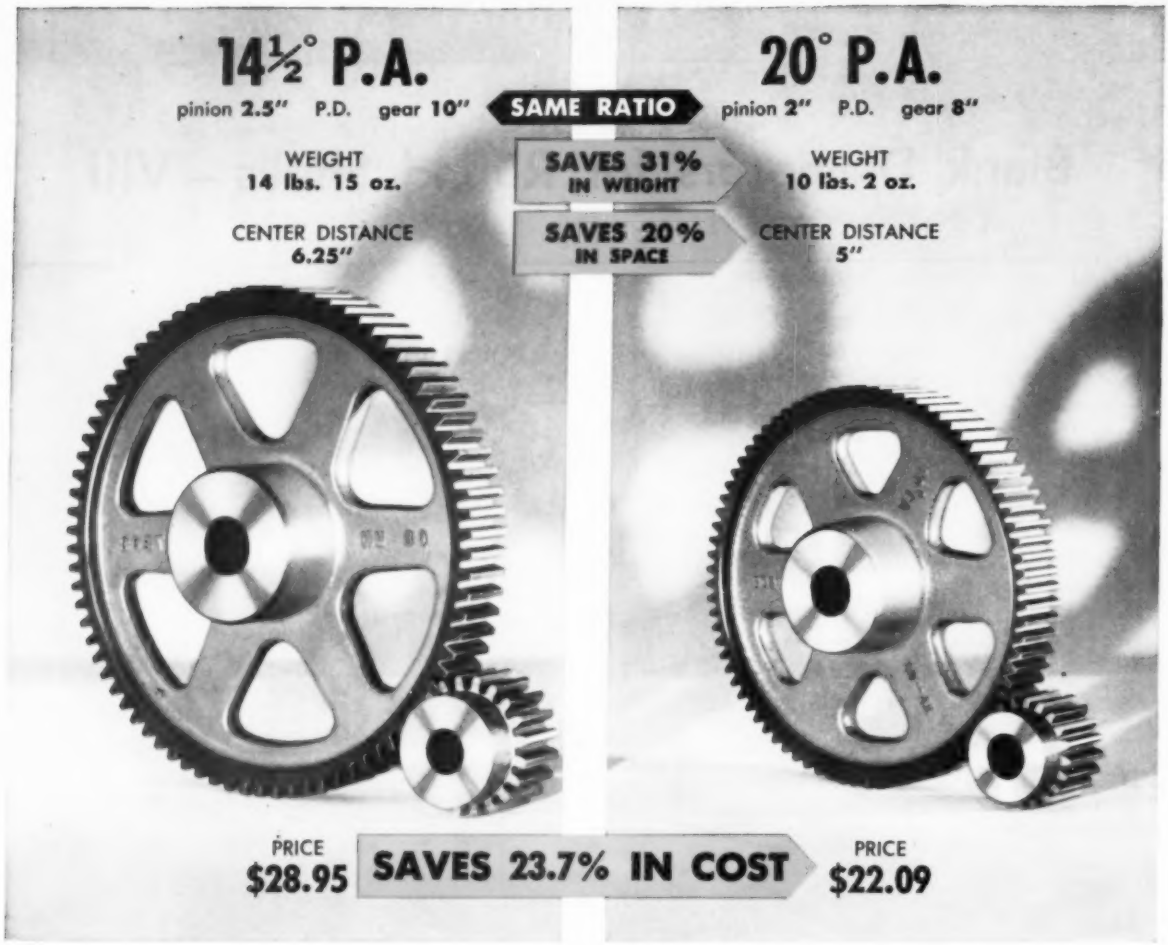
Area of required circle $= D^2 \cdot \frac{\pi}{4}$

$$D^2 \cdot \frac{\pi}{4} = \pi \cdot d_2 \cdot h + \pi \cdot f \cdot d_x + d_1^2 \cdot \frac{\pi}{4}$$

$$D^2 \cdot \pi = 4(\pi \cdot d_2 \cdot h) + 4(\pi f \cdot d_x) + d_1^2 \pi$$

$$D^2 = 4(d_2 \cdot h) + 4(f \cdot d_x) + d_1^2$$

$$D=\sqrt{d_1^2+4(f \cdot d_x+d_2 \cdot h)}$$



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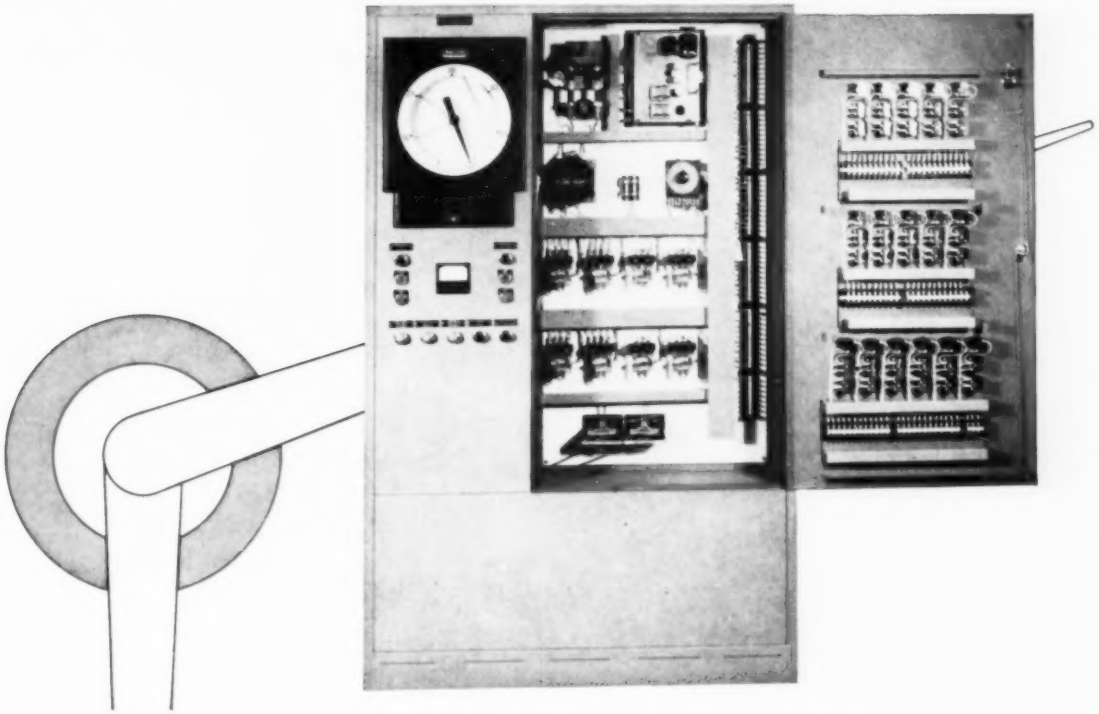

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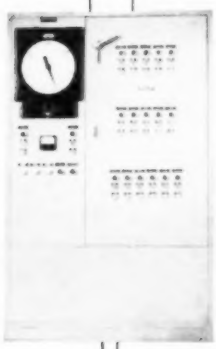

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Industry's new standard as published in J. I. C. Recommendations (April, 1959) and S. A. E. Standards (1959 Handbook)

Why accept less?

Parker-Hannifin now offers a new standard *at no extra charge*—high-pressure hydraulic components with straight thread port connections* for O-ring type fittings. This new standard—assuring a leak-proof and drip-free seal—is the most logical engineering approach to the problem of hydraulic circuit connections. The Joint Industry Conference Recommendations now state:

"Fittings that incorporate separate synthetic or metal-to-metal seals, or seal with pressure *should* be equipped with Unified National Fine (UNF) straight thread port connections."

And the Society of Automotive Engineers' 1959 Handbook states:

"The S.A.E. straight thread 'O'-ring boss is the preferred port for use in hydraulic devices."

Both support this new standard—and the U. S. Navy Bureau of Ships in MS16142 (SHIPS) has adopted the S.A.E. Straight Thread Boss Design as their straight thread standard for use in hydraulic and air systems in Naval ships. Such extensive support is understandable. The Parker-Hannifin straight thread port connections combine a built-in pressure sealing device with a rigid mechanical connection. This contrasts with the loose connection of a "backed-off" pipe thread and a relatively weak auxiliary sealing device.

Straight thread fittings and port connections are not a proprietary product or design. Although developed by Parker-Hannifin, they were immediately made available to the fluid power industry on a completely open basis.

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Now machinery builders and users alike are turning to this proved method of port sealing. Pipe threads for high-pressure hydraulic applications are fast becoming obsolete as more and more leading manufacturers recognize these advantages of straight threads in their production equipment:

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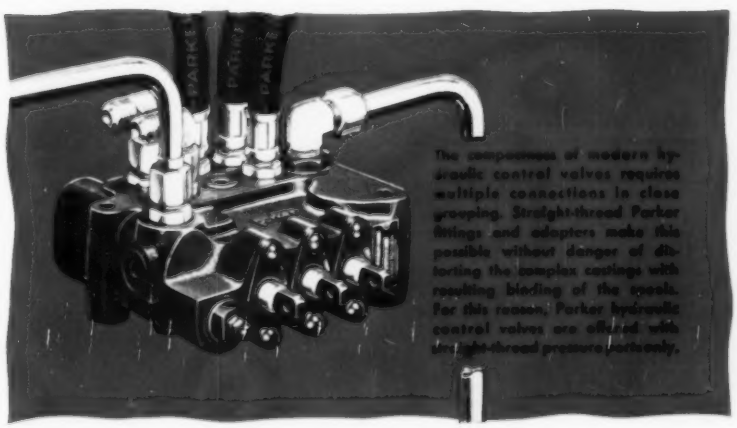
The O-rings used in Parker port connections are made only from service-tested Parker Seal Company compounds. With an ever-increasing number of fire-resistant fluids now on the market, it pays to avoid "jack-of-all-fluids" seals and stay with the Parker Seal compound specifically made for the fluid you will be using.

There's a complete line of Parker straight thread O-ring fittings and adapters for you to choose from... Triple-lok (flare type) and Ferulok® (flareless, bite-type) either method assures you leak-proof, trouble-free hydraulic connections.



The compactness of modern hydraulic control valves requires multiple connections in close grouping. Straight-thread Parker fittings and adapters make this possible without danger of distorting the complex castings with resulting binding of the spools. For this reason, Parker hydraulic control valves are offered with straight-thread pressure portsonly.

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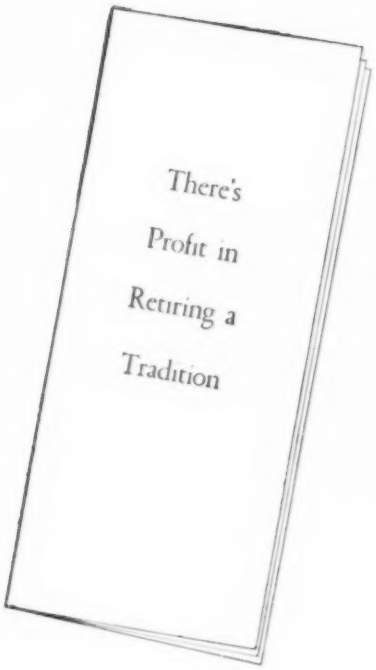

SEND FOR THIS BOOKLET TODAY!

With rising costs and increased competition from both foreign and domestic sources . . . you will find this a timely review of how some shops are reducing machining costs per piece by retiring certain outmoded ideas. As one plant owner did, perhaps you too will conclude . . . "A cutting edge on an indexable carbide insert that costs only a few cents is an extremely small price to pay for the efficient use of machines costing thousands of dollars."

Proof? Check actual on-the-job results shown in the table below

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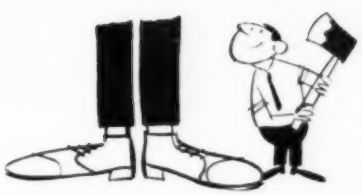
Typical Examples — Same Machines . . . Same Tools . . . Same Workpieces								
	Job No. 1		Job No. 2		Job No. 3		Job No. 4	
	240-Minute Tool Life Setup	25-Minute Tool Life Setup	75-Minute Tool Life Setup	25-Minute Tool Life Setup	120-Minute Tool Life Setup	80-Minute Tool Life Setup	120-Minute Tool Life Setup	22-Minute Tool Life Setup
Machine Cost per Hour	$ 8.00	$ 8.00	$10.00	$10.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Tool Cost per Hour	$ .04	$ .40	$ .36	$ .76	$ .14	$ .215	$ .14	$ .77
Cost per 8-Hour Shift	$64.32	$67.20	$82.88	$86.08	$73.12	$73.72	$73.12	$78.16
Pieces per Shift	51	181	8	17	94 hrs./pc.	41 hrs./pc.	8	16
Cost per Piece	**$ 1.26**	**$ .37**	**$10.36**	**$ 5.06**	**$859.16**	**$377.81**	**$ 9.14**	**$ 4.88**
Cost Reduction	70%		51%		56%		47%	

Talking Shop...



What All Abhor

WE WERE VERY YOUNG when we first heard that nature abhors a vacuum. It is a basic lesson we all keep learning. Laurence Crooks of Consumers Union put his finger on the cause of the foreign car invasion when he said that it was the result of a vacuum created by the continued expansion of the "small, low-price" American cars. In the same way we have noted that a large part of the rise in the sale of imported machines has been the result of a low pressure area left as U S machines got bigger, more complex, and more costly. You'll find the same rule in operation in your own plant. If you neglect any process or area too long, it will develop a low-pressure center. A production man who gets careless and misses a new idea too long will find somebody else rushing in to fill the vacuum. The out-of-date production man then finds himself swept aside.

If this department seems to harp frequently on this theme it is because we have seen enough examples of it to convince us that one of the greatest obstacles to success is ignorance of what others are doing.

Hot Air Tool?

NOW THAT WE'RE experimenting with liquid as a cutting tool, we might as well go on and try gas. Dr Robert H Johnson of GE Research says that's how the holes get in meteorites. Whirlpools of hot gas at hypersonic speed form within minute surface flaws and "machine" them out to deep, smooth cavities.

European Term

THE OTHER DAY we ran across a term that we have seen frequently in European publications: rationalization of industry. We've given it a double take each time, and on the second take, we've figured they meant something like modernization or automation - carried - to - the - point - where it's - rational.

This time, though, we didn't have to guess. An editorial in *Sign of Progress*, published by Phoenix-Rheinrohr AG, a German steel company, says that ". . . rationalization measures . . . are aimed at the improvement of the methods of operation in factory and administration, at efficient management of labor, planned economy, uniformity and quality of all products, and in the last analysis, at the secured existence of our enterprise and the preservation of the jobs of our employees in the future."

We caled Maurice Feldman, who sent us the magazine, and found that the term has this meaning, not only in Germany and Austria, but also in the Scandinavian countries, in Italy, in France, and sometimes in England.

Mr Feldman also pointed out that the word rationalize comes from the Latin stem *ratio*, meaning reason or sense. Thus, rationalization of industry, as the term is used in Europe, is the process of making sense in industry and in management.

That covers a lot of ground. We wish the United States had a nice, simple way to say the same thing. But we can't use the word rationalize, because it has a special meaning here. Can you imagine an article entitled "Rationalize now!" or a special report called, "Production man's guide to rationalization"?

MEMOS

by BESS RITTER

If electric car enthusiasts of the early 1900's had had their way, today's automotive mechanics wouldn't know a thing about spark plugs and transmissions. Instead they'd be concerned with problems such as charging one-ton-sized batteries. Most society women drove electrics, because they were simple to operate; because they were clean; and because manufacturers offered models that were styled to perfection. There were flower vases on the inner walls and draperies tastefully hung at the windows.

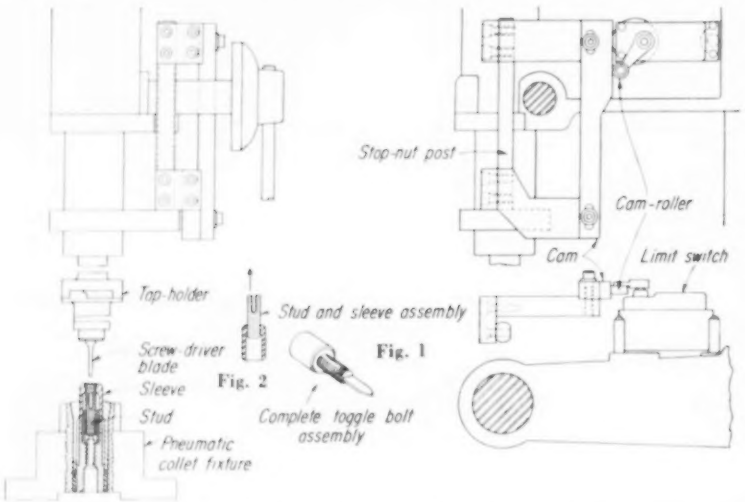
Most physicians who owned cars preferred electrics, because they were reliable and because they were fast. Shops maintained electric "wagons" for delivery purposes because the mechanism of the electric was so simple that anyone could drive it, almost at once. There were even electrically powered taxicabs, which were operated under the supervision of the Electric Vehicle Co in New York, Chicago, Washington, Philadelphia, Boston and Buffalo. It was a company ruling that the driver change the battery after every fare—even if the car had only been moved three or four blocks down a city street.

There's a good reason why that special short crowbar which burglars use for prying their way into buildings is known as a "jimmy," and it dates back to the Middle Ages when this tool was first designed. It was customary then for every trade to be learned by serving as an apprentice to a master in the craft. This was true of bakers; it was true of silversmiths, and it also was true of thieves. These apprentices were all known by the common name of "James."

When a bright burglar invented the first short crowbar to help him in his work, he used it in substitution to the usual human apprentice. Consequently, he called it by the apprentices's name, and this practice was observed as the tool was imitated, and in due course "jemmy" was altered to jimmy."

Practical Ideas...

Drillpress Assembles Threaded Parts



Our jobbing screw-machine shop 'custom builds' a number of special small assemblies, one of which is a toggle bolt shown at Fig. 1 in the sketch. This assembly comprises a 2 7/32 in. OD by 1 9/32 in. long steel sleeve, one end of which is tapped ½ in.–13, the remainder of the ID being a full ⅝ in. diameter. A ½ in.–13 steel stud, not fully threaded at one end and slotted and cross drilled at the other end receives a toggle lever and pin. And a stamped steel lever with a pierced hole, and a stainless steel pin.

Assembly is made by inserting the slotted end of the stud into the threads through the ⅝-in. base of the sleeve. Thus the stud is spun through until its shallow threads seize in the sleeve, Fig. 2, thereby fulfilling the specification requirement of a captive bolt. The toggle lever is then inserted in the slot and secured with the stainless steel pin which is peened at both ends.

A standard bench-model drillpress, its motor wired for left-hand rotation of the spindle, powers the mechanical-assembly tooling for the toggle bolt. The workholder is a pneumatically operated collet fixture activated by a single solenoid 4-way air valve. This valve is in turn controlled by a limit switch working against a cam affixed to the drillpress stop-nut post. A releasing-type tap holder, fitted with a screwdriver blade, is mounted in the spindle to drive the stud.

The assembly tooling is operated as follows: a stud is inserted, shallow-thread end foremost, into a hardened guide sleeve within the 27/32-in. collet. A sleeve to be assembled is then placed on top of the stud, ⅝ in. hole downward, and as the operator presses the sleeve down, contact between the two parts is insured by the spring-loaded plunger centered in the stud-guide sleeve.

At this point, the driver is released and stationary, but as it is brought down two things happen. The driver blade enters and bottoms in the stud's slot causing the clutch faces of the tap holder to engage, and, at the same time, the cam trips the limit switch energizing the collet fixture which grips the 27/32-in. dia sleeve.

While the operator maintains only enough pressure to keep the driver clutch engaged, the stud threads into the sleeve. At the appropriate moment, the limit switch de-energizes the collet fixture allowing the assembly to rotate until complete retraction disengages the clutch.

William G Bruce, Wiston, Ont, Canada

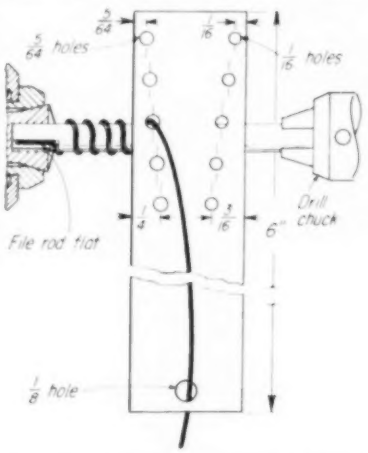
Spring Winder Provides Various Pitch Settings

Next time you want to make some small springs (up to ½-in. diameter) why not try a method that's proved fast and easy in our shop? All you need is a lathe, some piano wire, and the little spring winder described here.

First, select a piece of steel about 1 in. by 6 in., and ⅛ in. thick. As shown below, drill five holes in line down each side, with centers spaced at ¼-in. intervals along the length. Next, drill a ⅛-in. hole in the center of the piece, about ½ in. from the bottom edge, and countersink all holes on both sides to remove the sharp edges. Then harden the winder to about 58 Rc.

Now you are ready for winding. Select the diameter music wire you'd like to use, and a rod for the inside diameter of the spring. File one end of the rod flat to accept the wire. Now place both the wire and the rod in your lathe collet, and support the other end of the rod by using the tailstock drill chuck for a bearing.

To wind the spring, simply insert the piano wire through the bottom hole in the winder, and then through the hole in top which gives the desired spring loop spacing. When

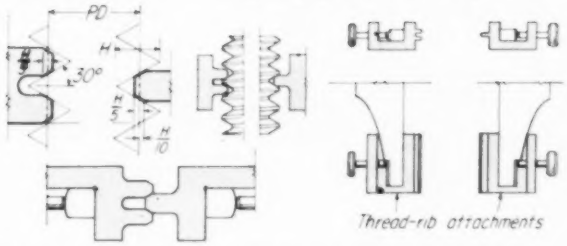


winding, turn the lathe over by hand, or run it at a very low speed setting. Be sure to grasp the winder firmly. You can experiment with it to find the amount of tension you must apply.

Once you've completed the winding remember to collapse the spring to its shortest length before unwinding it, otherwise it will lose its tension. Therefore, force the entire wound coil along the rod until the spring loops are completely closed, then release tension by turning the machine in reverse.

James E Carey, Fairport, NY

Thread Rib-Equipped Calipers Simplify Pitch-Dia Gaging



Thread-rib attachments

When you're machining threads, one of the biggest headaches you're likely to run into is measuring pitch diameter. Generally you'd use three wires and a micrometer to measure PD, but it's awkward and slow. Here's an easier way. You can turn your vernier calipers into a pitch diameter gage by adding "thread rib" attachments that will find PD's quickly and accurately.

The "thread ribs" are actually channel shaped steel blocks that screw clamp onto your calipers as shown in the sketch. You'll need a different set of ribs for each pitch thread you want to measure.

Notice in the figure above that the ribs make contact with only 1/5 of the theoretical thread height, H. For this reason, the minor variations in thread angle that may come up won't throw your PD measurments off, since the ribs make almost a point contact with the threads.

To use the thread ribs, select a pair corresponding to the pitch thread you want to measure. Place them on the caliper jaws, and align the ribs by closing the jaws, holding the jaws closed with slight pressure, and tightening the screws. In this position the ribs won't be aligned with the helix angle, but in most cases the contact surface is so small the error will be negligible.

But you can even reduce this slight error if you place a thread gage between the ribs, then tighten the screws so that the ribs align themselves with the helix angle of the gage.

There are two ways you can measure PD's with the ribs.

Method A: Place a gage block between the ribs, with a height equal to the pitch diameter minus H/5. (Here, H is the theoretical thread height, or the height you would see if the thread profile was V-shaped.) Record the vernier scale reading. If the PD of the thread you want to measure is correct, the vernier should read the same when placed on that thread. If the readings differ, the difference tells you how far off the PD of the thread is.

Here's an example. Suppose you want to measure the PD of an American Standard, ½—13 thread.

(1) Find the proper pitch diameter, which in this case is (from tables) 0.450 in.

(2) Calculate the theoretical height. $H = \frac{\text{pitch}}{2} \times \cot 30°$. (Use 30° since American Standard threads are inclined 30° from the vertical)

$H = \frac{1/13}{2} \times 1.732 = 0.066.$

(3) Divide H by 5. $H/5 = 0.066/5 = 0.013.$

(4) The height of the gage block you should place between the ribs is (1) – (3) = 0.450 – 0.013 = 0.437 in.

(5) Place a 0.437-in. gage block between the ribs and record the vernier scale reading. Suppose it turns out to be 0.937 in.

(6) Now measure the PD of the thread by placing the female rib over a thread tooth, and the male rib in an opposite tooth space, and record the vernier reading. Suppose now its reads 0.942 in.

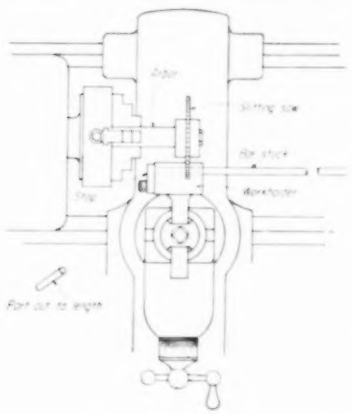
(7) Then the PD is too large by (6) – (5) = 0.942 – 0.937 = 0.006 in.

(8) PD = (1) + (7) = 0.450 + 0.006 = 0.456

Method B: Close the ribs and read the starting point on your veriner. Then measure the thread you are interested in and record the reading. The pitch diameter of the thread will be the difference between the second measurement and the first.

These ribs will give you PD's quickly and simply. The ribs are easy to attach and remove, and the range of measurements is limited only by the length of the vernier caliper arms, about 4 or 5 in. for a 10-in. caliper.

Ch. Minaire, St. Etienne, Loire, France



Slitting Saw Cuts Stock to Size

How many times have you been annoyed by a small tit on the end of a workpiece after parting to length on an engine lathe? Why not cut the workpiece to length in a preliminary operation which leaves a good end finish? Here's how you can do it with a slitting saw mounted on an arbor clamped in the headstock of your lathe.

Cut an aluminum block to fit the toolpost, and drill a hole in it to hold the stock. Since this hole is on the same center as the headstock, you can drill it by mounting a drill in the headstock and feeding the aluminum block into the drills. Make a simple swinging stop to position the workpiece in the block as shown at left.

Mount a saw arbor, with slitting saw attached, to the headstock. Then insert the workpiece in the aluminum block and feed the saddle inward until the saw marks the block. Use this mark as a handy reference, and dial to adjust for length.

In production, simply butt the piece against the stop, feed into the saw, then remove the work through the swinging stop. You will find this setup ideal for short-run production, and capable of making clean cuts within a thousandth's tolerance.

Elmer D Landauer, Paoli, Pa

Practical Ideas...

Auto Junk Parts Make Good Welding Accessories

An automobile junk yard provided a pair of wheel hubs and spindles which we have transformed into welding aids. One of the units is constructed to be used on the bench; in other words, the work surface of this unit is welded to the hub via short pipe legs to make a low revolving work table.

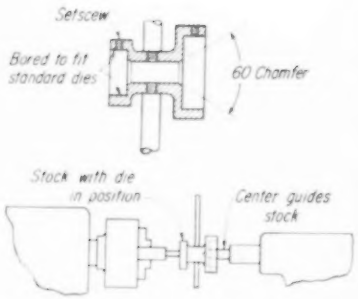
The floor stand seen at the right in the photo is fitted with 3-ft-long pipe legs, on top of which an old sprocket is welded. This stand affords a convenient working height for the work it supports. Both units can, of course, be moved about; the bench model to any section of the bench, or when a tall piece has to be worked on, to the floor.

The floor model is most often used in torch cutting which sometimes requires that the stand be moved to the work. The outstanding feature about these accessories, and the reason for their construction, is that they rotate easily. The slightest touch on the edge of either table, even when heavily loaded, is sufficient to make them revolve.

Harry J Miller, Sarasota, Fla

Twin-Die Stock for Lathe Use

Screw cutting with an ordinary stock and button die is risky when true-running threads are required. Few of these tools have sufficiently accurate guides, and some have no guides at all, to establish and hold concentricity. Should it, therefore, become necessary to generate threads with stock and die in a lathe, the problem of alignment is even more

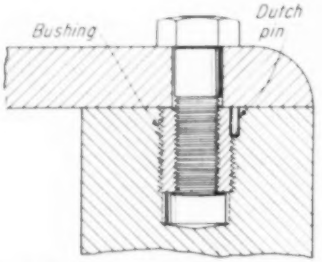


difficult to overcome. Attempts at hand guiding a stock can be dangerous and usually result in inaccurate threads.

The sketch illustrates a twin stock I designed to be used primarily in a lathe. Its two ends, which are recessed to accept standard and large-diameter button dies, are parallel with each other on a perpendicular plane with the bore.

A 60° chamfer at each end of the bore provides seats for the tailstock center which are used to start and follow up the stock and die during threading. Like standard stocks, both recesses are provided with setscrews for securing the dies. Handles are threaded into undercut section of the twin die stock.

F C Ashton, Woolton, Liverpool, England



Bushing Provides New Threads

When a thread, tapped into soft metal or poor casting, becomes useless because of overload and repeated use, there is a simple remedy. Increase the diameter of the hole to receive the next conveniently larger tap.

A bushing, containing the new threads, is then screwed into the enlarged hole and made immovable with a small-diameter dutch pin. The end of the bushing is next filed flush with the top of the component and the new thread is ready for use.

Federico Strasser, Santiago, Chile

R C Gordon
Bangalore, India

WON

$25 **In addition to regular payment for his idea:**

METAL SPRAY PRODUCES MOLD

in the May 18, 1959 issue

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PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers in asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

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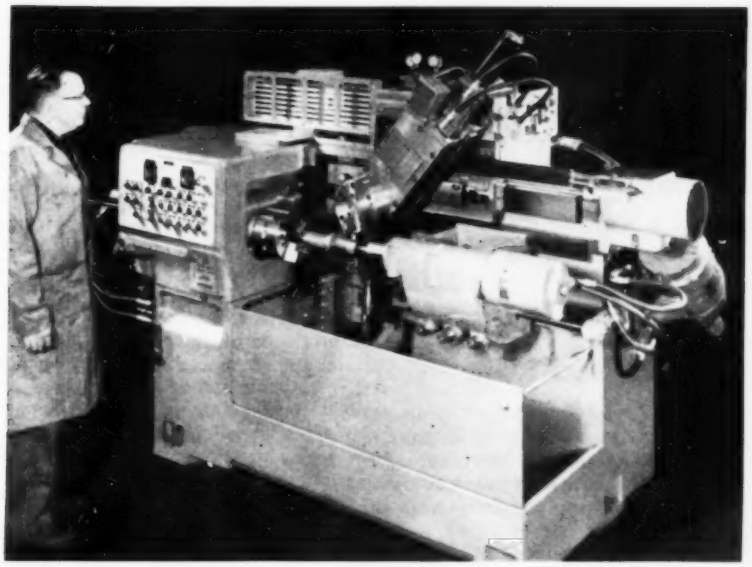
New Shop Equipment
Materials and Parts



Sundstrand Introduces New Multi-Cycle Hydraulic Tracer Lathe With 25-hp Motor

This 25-hp multi-cycle tracer lathe, designed with closely coupled stylus and cutting tool, can make up to three roughing cuts and one finishing cut from the same templet.

Model 14T-25 has a transmission type head which provides an automatic speed change for the finishing cut. Standard models can be supplied with two or four-speed heads. Spindle speeds are 340 to 3100 rpm with the two-speed head and 225 to 3100 rpm with the four-speed head. Feed is infinitely variable within a range of 4 to 50 ipm. Rapid traverse is 230 ipm.

Maximum length between centers is either 24, 32 or 40 in. Maximum turning diameter is 4½ in. and minimum diameter of finished parts is ½-in. Facing slides can be provided with a maximum stroke of 3½ in. and rapid feed rate of 36 ipm.

To simplify setup and insure accuracy, graduated scales are provided for dog setting, templet positioning, tailstock positioning, and crossfacing slide location. Dial indicators at the top of tracing carriage permit accurate depth setting of the first three cuts. After the three roughing cuts are taken, the tool turret indexes for the finishing cycle with a 0.020-in. depth of cut.

With this arrangement, it is practical to use carbides for the roughing cuts and ceramics for the finishing cut. On many jobs, the finishes obtained make it possible to eliminate green grinding.

Work loading is simplified because the centerline of the spindle is within easy reach of the operator, and the open loading area makes it easy to install automatic handling equipment. The large chip cavity in the machine base provides for easy chip cleanout and simplifies installation of automatic chip disposal units.

With this lathe it is possible to turn parts end for end quickly to machine both ends of the part. Quick accurate positioning of dogs and templets reduces downtime required for change over.

Sundstrand Machine Tool, Div of Sundstrand Corp, Belvidere, Ill

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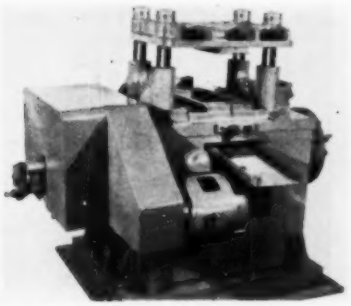

Cutoff and Pre-Notch Press Can Process Coil Stock

Heavy duty, flying die design Model 5-D is introduced for accurate high-speed production in cutting off or pre-notching rolled formed materials. Coil stock can be used instead of cut lengths, resulting in reduction of scrap and production of more uniform shapes.

Unit is available with operating speed of 300 rpm and in 4 to 120-ton capacities. Flag trip or positive mechanical run-out table can be furnished to requirements. Electrical clutch brake is furnished on 4-ton units, air clutch and air brake on 8 to 120-ton presses.

Dahlstrom Machine Works, Inc, 4227 W Belmont Ave, Chicago 41, Ill

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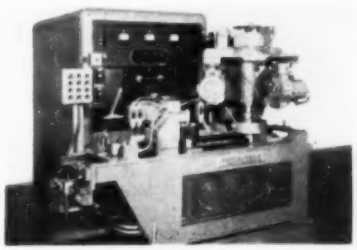

3-STATION, 3-HEADED AUTOMATIC ARC WELDER is designed to weld the parking gear to the carrier case assembly in automobile transmissions, a job previously done by rivets. Machine handles 180 pieces per hr when operating at 80% efficiency—*Progressive Welder Sales Co, Special Machinery Div, Pontiac, Mich*

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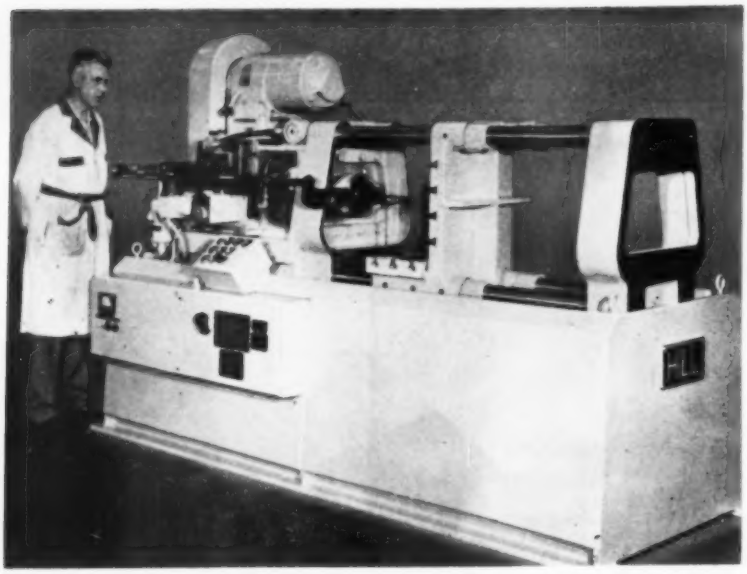

High-Speed Horizontal Drilling Machine Operates at 10 Times Usual Feed Rate

High-speed, single-spindle, horizontal drilling machine performs deep hole drilling, gun drilling, gun reaming, and precision boring. Called Hill-Drill, the machine is said to feed standard twist drills into steel at 10 times conventional feed rates while maintaining size accuracy and tool life. Suggested feed rates on the machine for a ½-in. dia standard twist drill in steel are 40 to 80 ipm.

The key to the high feed rates is the spindle. Driven by a 10-hp motor through V-belts and a multiple speed drive, the spindle is in the form of a 4-in dia hollow quill that travels in a honed Meehanite sleeve. Two 3¼-in. dia hydraulic cylinders, which develop up to 16,000-lb thrust, advance the quill.

Specifications include: 0 to 150-ipm feeds, 600 to 4000 rpm spindle speeds, 12-in. head travel, 4-ft. linear table adjustment, 18-in. x 24-in. x 3 ft. long part capacity.

Drill head, universal fixture mounting table, and the four 3-in. dia guide bars on which the table slides are a unit construction, supported by the welded steel base of the machine. The table has T-slots in both directions and an 18 x 24-in. vertical surface and a 12 x 18-in. horizontal surface. This table can be equipped with a numerical positioning system to eliminate jigs and fixtures.

An adjustable load meter, which measures drill torque, protects the tools from breaking under overload conditions by automatically retracting and re-feeding the drill spindle into the work. An electrical feed rate indicator that operates in either direction shows the feed rates in increments of 5 ipm.

Walter P Hill, Inc, 22183 Telegraph Rd, Detroit 19, Mich

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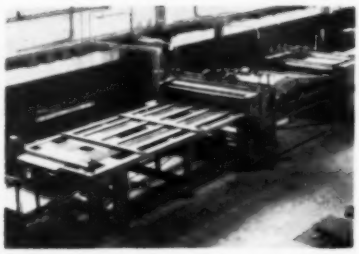
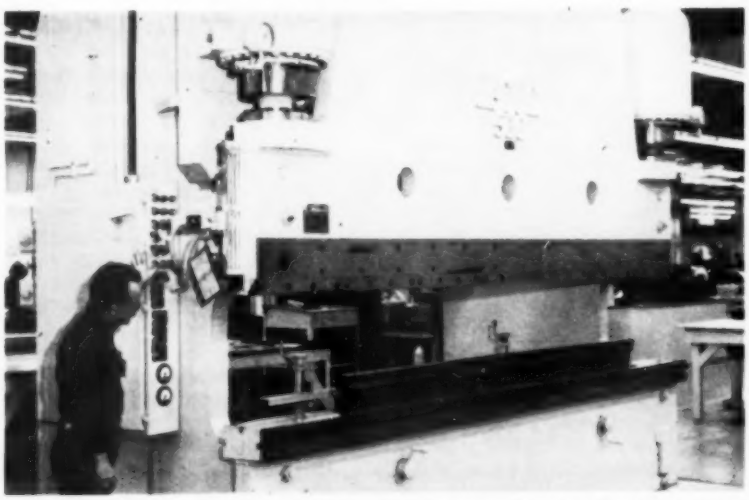


Dahlstrom Shear Lines Feature Dual Measuring Methods

Combination of electronic surface measuring and positive mechanical measuring provides extreme flexibility in processing coil stock to sheets.

Surface measuring system recommended for light gages at production speeds and heavier gages at a speed proportionate to gage, eliminates minimum and maximum length restrictions; it also allows instantaneous length changeover. Tolerance is always based on a plus or minus factor. Positive mechanical measuring system, for heavier gages at production speeds and lighter gages at a speed proportionate to gage, has minimum and maximum length restrictions. Fast changeover of lengths is accomplished through a motorized screw arrangement with direct length reading to a decimal counter. Overhead trapping of metal on measuring conveyor minimizes



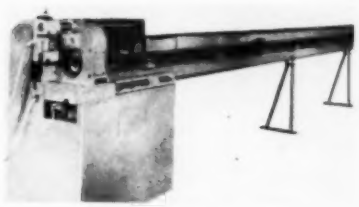
500-TON HYDRAULIC PRESS BRAKE, especially designed for hot forming, is being used at Boeing, Seattle, for investigation work on titanium and other high-temp metals. Series of pushbuttons automatically control rate of advance of the ram which dwells for a predetermined interval above material being hot-tool heated up to 1200 F, then descends into the metal at a preselected rate. Adjustable combinations of forming rates and dwell and soak intervals permit automatic cycling for a variety of metals and requirements—*Pacific Industrial Mfg Co, 848 49th Ave, Oakland, Calif*

MORE DATA? Circle 55, inside back cover

compaction between measuring head and shear blades. Tolerance is always based on a plus factor only. Dual arrangement of measuring is optional on all new Dahlstrom shear lines.

Dahlstrom Machine Works, Inc, 4227 W Belmont Ave, Chicago 41, Ill

MORE DATA? Circle 56, inside back cover

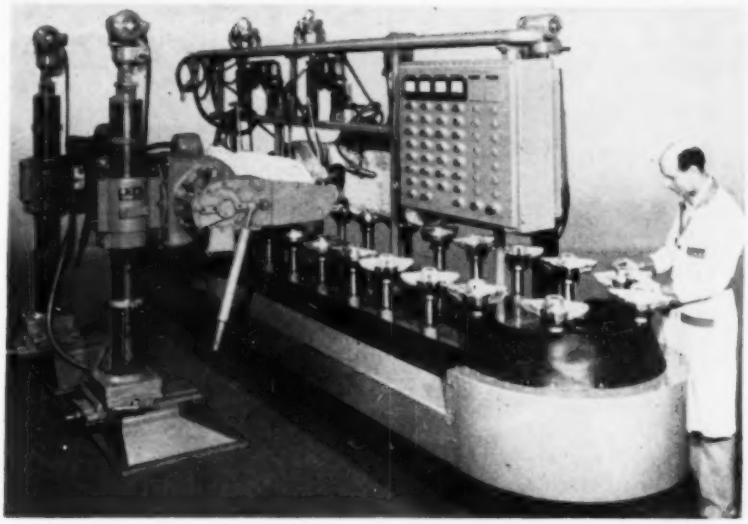


Brehm Tube Cutting Machine Offered in Larger Capacities

Machine is available in two basic sizes, ⅜ to 2¼ in. and 1 to 4½ in. Tube cutting rate is over 7000 per hr depending on length of the part. Machine will cut almost all types of material, producing free edges and little part distortion. Cutting is performed by a shearing action, eliminating scrap loss.

Vulcan Tool Co, 730 Lorain Ave Dayton 10, Ohio

MORE DATA? Circle 57, inside back cover



Line-Type Automatic Polishing Machine Provides Compact, Flexible Operation

Acme line-type automatic polishing machine is said to provide maximum compactness and operation flexibility for high production parts. The machine consists of an in-line conveyor that moves workholding platens around the periphery of the unit, where individual lathes perform the polishing operations. The conveyor is made up of standard 4½-ft sections.

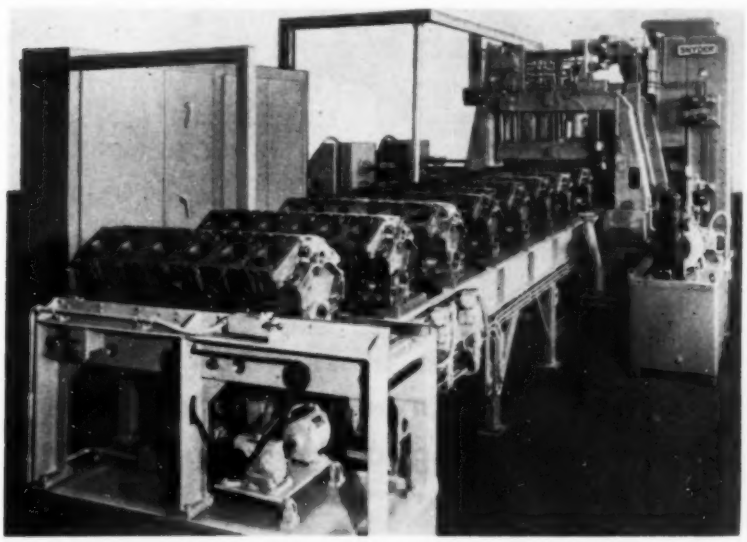
A motorized chain drives the one-foot-long cast-iron platens at feed rates of 4 to 29 fpm, either in continuous motion or station-to-station indexing. The work spindle assembly attached to each platen has a sprocket which can be driven in either direction at any position along the conveyor to provide efficient polishing speeds. Spindles can also be provided with camming surfaces for preset work motions.

Each of the adjustable lathes, which can be equipped with rotating buffs, polishing wheels, or abrasive belt heads, has interchangeable power drive for raising or lowering the wheel heads. Compensation for wheel wear can be done manually or automatically in pre-set cycles and feed amounts. Liquid compound applicators, which can operate from standard plant compressed air lines, are provided for each polishing station.

The machine illustrated, used to buff hub cap spinners, has a 32-ft periphery and spindle centers 24-in. wide. It uses four heavy-duty lathes, powered by 15-hp motors. The final lathe, which performs a coloring operation, has a 370 to 2230-fpm variable speed drive.

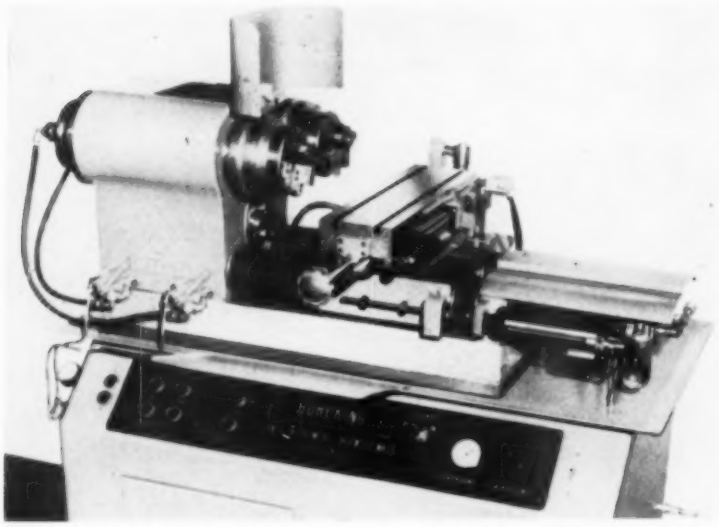
Acme Mfg Co, 1400 E Nine Mile Rd, Detroit 20, Mich

MORE DATA? Circle 59, inside back cover



LARGE CAST IRON V12 TRUCK ENGINE BLOCKS are bored and precision-line bored at rate of 31 pieces per hr at 100% efficiency on this 7-station, 35-ft long hydraulically operated, electrically controlled transfer machine. Unit receives blocks from factory conveyor; they are automatically loaded into the machine and transferred through the various idle and machining stations by a walking beam type of transfer mechanism. Blocks are automatically placed back on another factory conveyor after processing—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich*

MORE DATA? Circle 58, inside back cover



Twin-Spindle Automatic Cycling Machine Does Precision Boring, Turning, Facing

The Boreking, added to Atlantic Instrument Corp's line of Unimatic boring machines, is designed to perform a complete finishing operation on a blank in one cycle. While the front of the piece is being finished on one spindle, reverse side may be done on the other. With proper tooling, it is possible to perform multiple operations such as boring, facing, and turning. Automatic cycle can be set for any combination of feeds with fast approaches and returns where applicable.

Main table slides on two round, hardened and ground ways, protected by accordion pleated boots. Head and bed are scraped and fitted to a granite base of high permanency, lapped to flatness of .00005 in., resting on a rubber cushion. Machine is capable of repeating to a tolerance of less than 0.0002 in. on a face cut and 0.00005 in. on a bore.

Two air motor units allow for independent adjustments of the main table and cross-slide feed. Spindle speeds are infinitely variable between 400 and 4000 rpm, and can be set independently for each spindle. Drive is from a single ¾-hp motor with a variable speed drive. Unit, mounted on a welded steel cabinet with a tool storage compartment, requires floor space of 28 x 52 in. According to the manufacturer, this machine satisfies requirements of space ,ge precision and production.

Distributed by Russell, Holbrook & Henderson, Inc, 298 Madison Ave, New York 17, NY

MORE DATA? Circle 60, inside back cover

New Coolants Up Production A Minimum of 25%

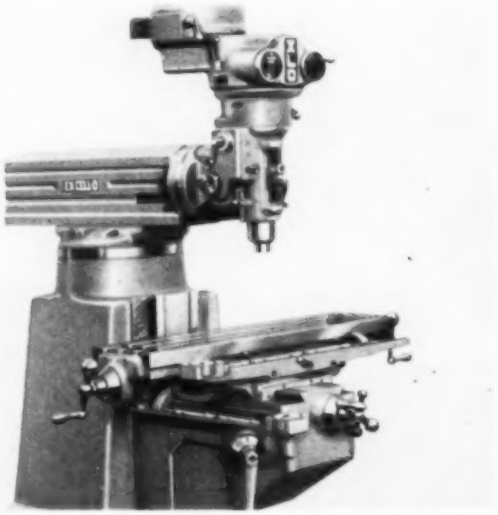
Two water soluble cooling compounds have been developed for work on toughest metals including beryllium copper, stainless steels, and nickel alloys.

Cutting compound, called Saffire EP Soluble Oil, is reported to have upped production over 75% in most cases and, in some instances, doubled tool life while working 4130 steel in solution of 40:1. It has also been used in drilling Hipernick, previously considered almost impossible to drill. Saffire grinding compound is transparent, contains no wax. Case histories indicate production increases of more than 50% grinding 4130 steel in solution of 100:1.

Both compounds are stain and rust-proof, odorless, and will not affect paint or harm skin.

Saffire Mfg Co, 924 E Main, Alhambra, Calif

MORE DATA? Circle 61, inside back cover



Ex-Cell-O Ram Turret Milling Machine Offers Dial Setting for Spindle Speeds

Spindle speeds on this ram turret milling machine, which are infinitely variable from 90 to 2900 rpm, can be set by engaging or disengaging back gears and turning a dial.

The milling head pivots in planes both parallel to the work table and at right angles to it. Power feed to the spindle is standard equipment, with three speeds available in both directions. The power feed can be disengaged when not required and the spindle can be braked to an instant stop. Rack and pinion are used to adjust the turret, which can be rotated 360°.

Specifications include: 16 in. ram travel, 21 in. table travel, 12 in. cross-slide travel, 1-hp motor on head, 4 in. quill stroke, 9 x 32-in. worktable, 17 in. work capacity, 45° forward and 30° backward swing of head, spindle feed of 0.0015, 0.003 and 0.005 ipr.

Ex-Cell-O Corp of Canada, Ltd, London, Ontario

MORE DATA? Circle 62, inside back cover

Automatic Standing-Wave Soldering Line Reported to Boost Production, Cut Rejects

An automatic standing-wave soldering system, offered as an integrated unit, is said to boost production speeds and all but eliminate rejects in processing circuit boards or other electronic or machine components. Product conveying, flux application, solvent removal, flux and board preheating and soldering are handled automatically by this straight-line system. It can be used to process components up to 9½ in. wide and up to any practical length. More precise production control and improved soldering conditions are said to result in higher shear strengths and greater reliability.

The heart of the system, called Flowsolder, is a unit that uses an impeller pump to bring molten solder up to the undersurface of the assembly in the form of a standing wave.

Major components of the Flowsolder system are special conveyor, fluxing unit, heat bank, adjustable board carrier, and, of course, the soldering unit.

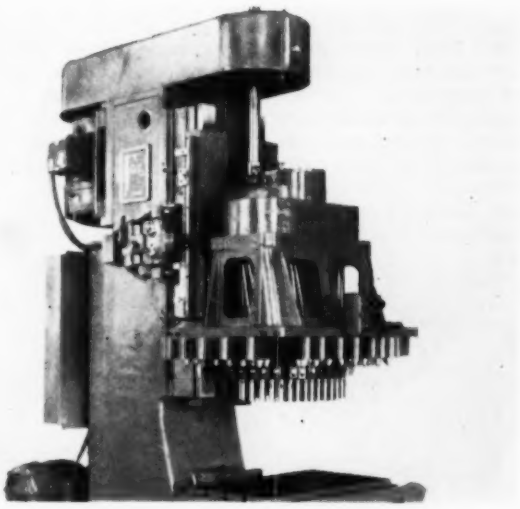
After the operator places carrier and board on the conveyor, the chain-drive transfer mechanism moves it along at speeds of 6 ipm to 15 fpm. The board passes through the standing-wave flux applicator and then over the infra-red heating unit where the flux solvent is driven off and the boards preheated. When soldering has been completed, the operator removes the board from the conveyor line. The adjustable board carriers may also be used as assembly fixtures to hold components.

Electrovert, Inc, 124 E 40th St, NYC

MORE DATA? Circle 63, inside back cover

PULLDOWN-JIGGER, reported to be the largest ever manufactured, measures 19 ft. 10 in. in height, will turn pieces up to 48 in. in dia. and 7 ft. high. It can be used to manufacture large pieces such as crucibles, retorts, insulators, and other items—*Crossley Machine Co, 304 Monmouth St, Trenton 9, NJ*

MORE DATA? Circle 64, inside back cover



Vertical Drilling Machine Offered With Adjustable-Spindle or Fixed-Center Heads

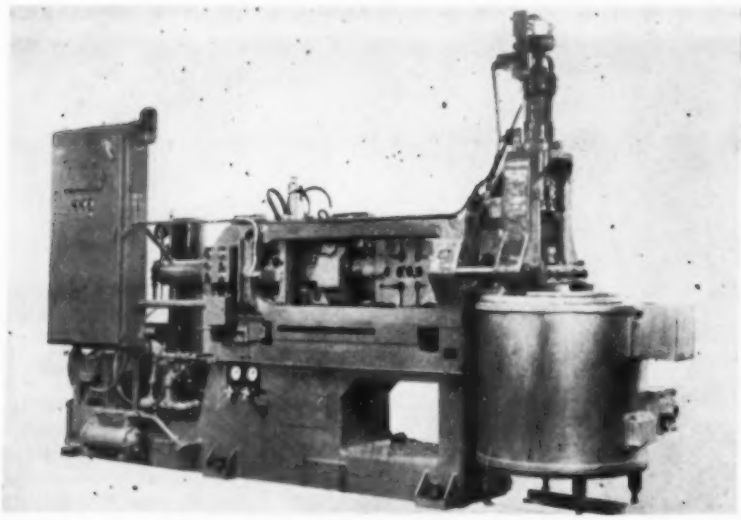
Type L-66-H multiple-spindle vertical drilling machine, with hydraulic feed, is offered in two models. One is equipped with an 18 x 26-in. adjustable-spindle head (illustrated) with 26 spindle pinions for 1⅜-in. universal joints and an adjustable-height table. The other has a 40 x 20-in. fixed-center head with 44 2-MT spindles and a fixed head box table.

Automatic cycling is operated by a Vickers 2-feed hydraulic panel with forward and reverse action initiated by solenoids. Coarse feed, fine feed, and stop positions are cam-controlled. The hydraulically-counterbalanced adjustable-spindle head features spindles pinions spaced for maximum coverage and generous head skirt height.

Specifications include: spindle speeds (for model illustrated), 356 to 1086 rpm; drilling stroke, 18 in.; head motor, up to 30 hp; coarse feed range, 0.4 to 17 ipm; fine feed range, 0.3 to 6 ipm.

Fox Engineering Co, 1336 Francis St, Jackson, Mich

MORE DATA? Circle 65, inside back cover



125-ton Automatic Zinc Die Caster Has High-Speed Cycles, Unit Frame

Model HP-1/2Z-SF which will cast up to 6¾ lbs of zinc provides over 1000 free cycles per hr. Source of speed is a 25-hp motor and a 2750 cu-in. accumulator. Field experience has demonstrated that automatic operation at such extremely high cycling speeds requires a much more rugged structure than conventional die casting. New model is offered as the only small capacity die caster with unit steel frame construction.

Dies up to 16 in. high requiring a 9-in. opening can be easily handled on the 18-in. horizontal x 21-in. vertical platens. Standard features include central screw die height adjustment up to 3 in., automatic cycling, low pressure die closing circuit, air-operated die clearing assembly, and SDCE ejector bar pattern.

Lester-Phoenix, Inc, Dept N-41, 2711 Church Ave, Cleveland 13, Ohio

MORE DATA? Circle 66, inside back cover

MULTI-UNIT AUTOMATIC performs 42 operations on two different plates for refrigerator compressors in two chuckings of each part. Six units with multi-spindle auxiliary heads drill, counters.nk, ream, and trepan at a gross rate of 300 parts per hr of each part. Bushings guide all of the tools. A 30-in. index table holds seven work fixtures; each fixture holds four parts, two different parts in both first and second chuckings—*Kingsbury Machine Tool Corp, Keene, NH*

MORE DATA? Circle 67, inside back cover

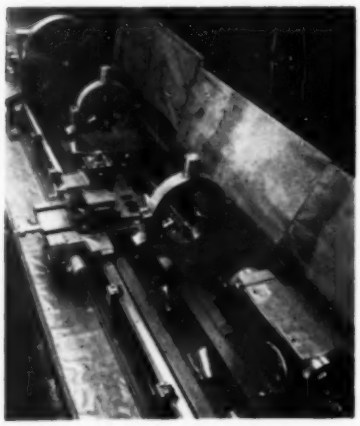
Wesson Standardizes Tracer Tool Components

Line of Multicut insert holders for tracer turning has been designed so that all component parts, except the holder shanks, are standardized and interchangeable. One anvil-locator, one clamp, one locking screw, one taper-head screw, and one diamond-shaped insert will fit all four holders.

The anvil-locator and the insert are precision ground so that 3/16-in. flats on both sides of the insert are held snugly in the anvil-locator. Side-cutting loads will not cause chatter or displacement of the insert.

Wesson Co, 1220 Woodward Heights Blvd, Detroit 20, Mich

MORE DATA? Circle 68, inside back cover



German Lathes Offered in Extra Large, Heavy Models

Barer-Meuser lathes have four bedways (two V-ways and two flat bedways) where the carriage travels on the two front ways, and the tailstock and steadyrests travel on the two rear ways, thus able to pass one another. The M VII S/4 has a width over ways of 53 in. and is available in 48, 58, and 68-in. swing, up to 60-ft centers. The M VIII S/4 has width over ways of 64 in., is available in 76, 86, and 96-in. swing, up to 100-ft centers.

Machines have 150-hp drive to the headstock spindle. Separate rapid traverse motors for carriages and tailstock are provided as well as hydraulic clamping of tailstock on bedways. Units are equipped with quick change gear boxes giving a range of 354 various thread pitches, 120 each longitudinal, cross, and top compound feeds. Rapid traverse in all six directions is also provided. Models have automatic top compound

feeds. A taper turning attachment for any length and any degree is made by mounting a large top compound with an additional bracket.

Distributed by Barer-Engineering & Machinery Co Ltd, Champlain, NY

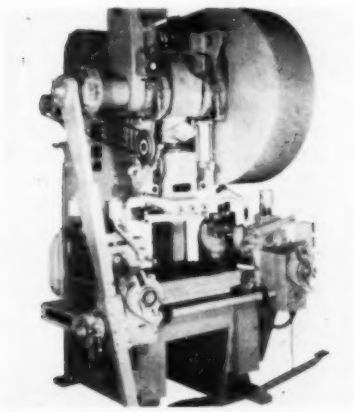
MORE DATA? Circle 69, inside back cover

Veet Improves Design of Double-End Radial Drills

Much heavier cast base replaces the former fabricated steel; it is 33% deeper and 8 in. longer, affording 20% more working surface on the lower table. A heavy X-member frame is cast into the base, with 4 T-slots draining back into the integral coolant tank. Gusher double-inlet pumps are built in when ordered with coolant system.

Veet Industries, East Detroit, Mich

MORE DATA? Circle 70, inside back cover



CAP PRESS with roll feed, Warco No. 60-1-14CG, is an open back, single crank, flywheel type unit in 60 ton capacity that operates at speeds from 75 to 200 strokes per min. Feed shown is double roll type for 0.060-in. material, 12 in. wide. Feed length is 0 to 12 in., max feeding speed 1200 ipm—*Federal Machine & Welder Co, Warren, Ohio*

MORE DATA? Circle 71, inside back cover

Automatic Production Machines Designed To Weld Straight-Line or Circular Seams

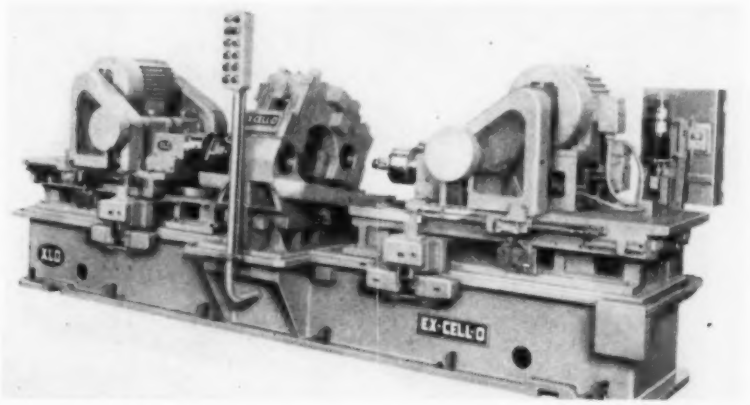
Series of automatic Heliarc welding machines are designed for precision welding of straight-line and circular seams. Based on Linde concepts and specifications, these machines are designed and built by Expert Welding Co of Chicago.

One of the first applications for these machines is welding coffee maker bodies. The accuracy of the machines coupled with precise electronic arc length control welding heads has made possible production of 2000 coffee maker bodies per day, with a reject rate of less than 1%. Costs of welding the coffee makers is less than the cost of deep drawn assemblies.

One machine welds the side seam of the coffee maker body; another (illustrated) welds the circular bottom into the body. On the side seam welder, a stainless steel sheet metal stamping, 0.028 in. thick, is loaded manually, and the operator presses two buttons to start the automatic cycle. The machine closes the seam, clamps the part against the backup mandrel, and introduces argon shielding gas to the underside of the joint. An electronically-controlled welding head establishes the arc, makes the weld, and extinguishes the arc. The circular bottom welder works similarly.

Expert Welding Machine Co, 17144 Mt Elliott Ave, Detroit 12, Mich

MORE DATA? Circle 72, inside back cover



LARGE CAST-IRON ROLLERS, components of track assemblies for heavy-duty tractors, are rough bored and plunge faced, plus precision finish bored and faced, in one machine cycle on this custom unit specifically designed for Caterpillar—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 73, inside back cover

Set Screw Feeder-Driver Has Detachable Gun-Type Driver

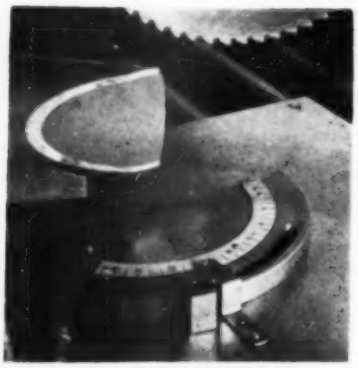
Automatic set screw feeding and driving machine is equipped with a gun-type driver that can automatically receive and drive 2000 screws per hour at distances up to 15 feet away from the base unit. For stationary use, the gun is held in an adjustable mount on the machine and is operated by a foot pedal.

Screw is fed to a selector from a rotating hopper. From the indexing mechanism, the correctly positioned screw is carried by air through a flexible tube to the driving gun, and is seated to a preset depth or torque.

The machine comes in three models to handle screws in diameters from No. 4 to No. 8, No. 10 to 5/16 in., 3/8 to ½ in. All models are table-top type for easy movement from one location to another. They operate on standard plant electrical and air supplies.

Bristol Co, Waterbury 20, Conn

MORE DATA? Circle 74, inside back cover



Cut-Off Fixture Speeds Pipe Joint Preparation for Welding

Preparation of pipe joints for welding is said to be speeded by this fixture which can be mounted on a standard Wallace Cut-Off unit. Pipe is positioned in the fixture according to a chart which gives the degree settings necessary for the joint angle required. According to the manufacturer, it is no longer necessary to make a template, draw it on the pipe, and cut by torch.

The cut-off unit uses an abrasive wheel for steel alloys and a metal wheel for aluminum. It can be used to prepare any angle from a tee, 90 to 35°. Preparation of a 5-in. pipe for a 45° connection to another 5-in. pipe takes 3 min. Operation can be performed by unskilled operators.

Wallace Supplies Mfg Co, 1300 Diversey Pkwy, Chicago 14, Ill

MORE DATA? Circle 75, inside back cover

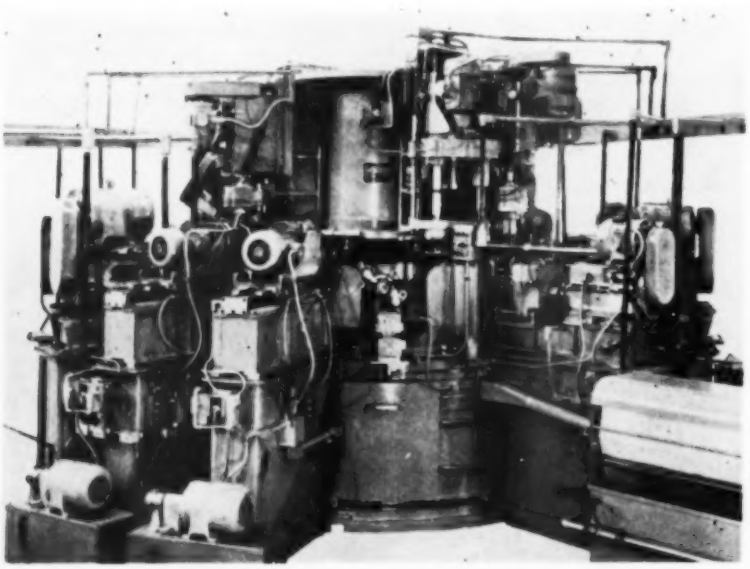
Scratch Investigation Microscope Measures Extruded Metal Surfaces

Recently developed attachments for the Hilger & Watts microscope permit its use for measuring scratches and pits on the external surface of extruded metals with diameters ranging from 0.125 to 3 in.

Instrument can be used on flat or curved surfaces; range of measurement is from 0.0005 to 0.012 in. Illumination of the surface is at an oblique angle, giving a magnification in depth of four times the lateral magnification. Unit is portable.

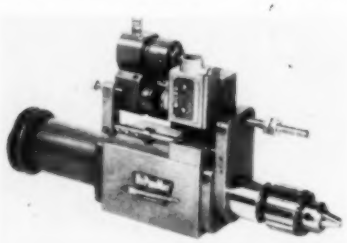
Distributed by Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill

MORE DATA? Circle 76, inside back cover



74 OPERATIONS ARE PERFORMED AUTOMATICALLY on one or two-cylinder refrigerator compressor housings by this 18-station center column machine. The machine is equipped with an 84-in. hydraulic indexing table and 74 spindles mounted on three Way-Type units, eight Cam-Matic drill units, and fourteen Air-Oil-Matic drill units. Time cycle is 30 seconds—*Morris Machine Tool Co, Cincinnati, Ohio*

MORE DATA? Circle 77, inside back cover



Hypneumat Introduces Two Drilling and Tapping Units

Two compact automatic drilling and tapping units have a 2-in. stroke with drill and tap capacity of ¼ in. in steel. Model S-200 EHB (illustrated) is the standard belt-driven unit. Model M-200 EHB has a ½-hp 1800 or 3600-rpm motor as an integral part of the unit. Maximum spindle speed

on both Hypneumat models is 8000 rpm.

Features include all cast iron and steel construction, six-splined drive spindle, double acting cylinder with equal thrust and retract piston area, and pneumatic feed with hydraulic restriction.

Hypneumat Inc, 647 West Virginia St, Milwaukee, Wis

MORE DATA? Circle 78, inside back cover

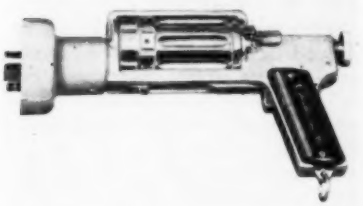
Instrument Measures Internal Grooves and Blind Holes

Quicktest line of dial measuring instruments with contacting feeler points is specially designed to measure the diameter of blind holes and internal grooves in difficult-to-measure situations.

The instrument has one rigid leg and one moveable leg. The distance between the legs is recorded on a 2½-in. dia dial. Needle-shaped straight or angular points can be supplied in various lengths and can be adjusted or replaced if they become worn. The instruments, each with a range of 0.4 in. can be furnished to measure diameter from 0.4 to 4 in.

Testing Machines, Inc, 72 Jericho Turnpike, Mineola, LI, NY

MORE DATA? Circle 79, inside back cover



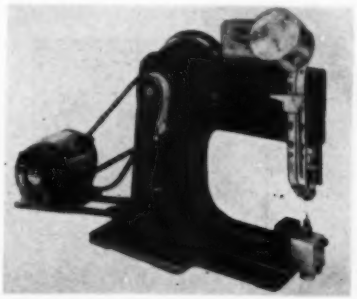
Automatic Stud Driver Sets 8 Fasteners from Single Load

Power-actuated Columbia-matic 8, for fastening into concrete, steel, and wood, can deliver up to 16 shots per minute, and has controlled automatic reloading. Extra cylinders and a press-type loading device are available for continuous setting.

Tool is packed in a metal carrying case with lanyard, goggles, ramrod, and cleaning brush.

Columbia-matic 8 Corp, Div of Columbia Mills, Inc, Syracuse 1, NY

MORE DATA? Circle 80, inside back cover



Automatic Tubular Riveter Is Heavy-Duty, All-Electric

ETCO Model 500 feeds and sets all kinds and sizes of tubular rivets from the smallest up to 5/16 in. in dia and ½ in. in length. Easily interchangeable feeding tracks and dies convert it for eyeletting.

Unit has deep throat, fast automatic feeding, automatic clutch. Designed for light assemblies, fabricating and fastening, printed circuits, electronic and electrical components, it is priced at under $600.

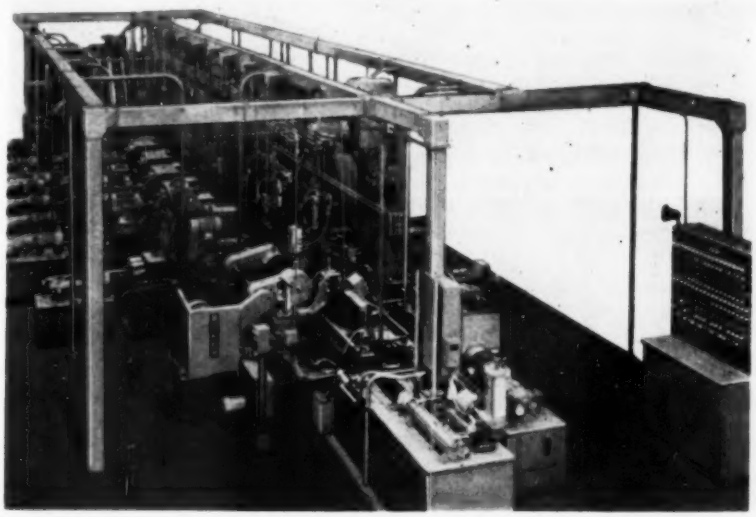
Eyelet Tool Co, 256 Broadway, Cambridge 39, Mass

MORE DATA? Circle 81, inside back cover

Printed Circuit Drilling Machine Drills Patterns at 60 per Minute

Operating from a master templet, machine will drill the most complex pattern at rate of 60 or more per min. Circuit boards can be drilled individually or stacked to a height of 2 in. for simultaneous drilling of a number of boards in each cycle. If stacked, a woodpeckering action of the drill is possible by addition of a repeat cycle timer that automatically withdraws drills to clear chips and prevent breakage. Any pattern can be duplicated to within 0.001 in. quickly and easily, according to manufacturer.

Machine consists of a stand with adjustable table and sturdy base, air-operated stylus and clamping de-



BEARING CAPS for 12-cylinder truck engines are drilled, bored, ground, and faced on this 24-station automatic transfer line. Machine then saws apart the individual elements of the cluster castings for delivery into their respective bins. Production rate is 70 parts per hr at 100% efficiency.—*Baker Brothers, Inc, 1000 Post St, Toledo, Ohio*

MORE DATA? Circle 82, inside back cover

vice, Dumore automatic drill unit adjustable vertically on column foot switch, and junction box. Drilling and clamping cycles are completely automatic and integrated. Length of stroke is 0 to 2 in.; drill capacity, No. 60 to ⅜ in.; speed range, 400 to 7420 rpm. Table work area is 12½ x 17, others on request.

Sullivan Automatic Specialties, Inc, 6705 Fourteenth Ave, Kenosha, Wis

MORE DATA? Circle 83, inside back cover

Mecha-Finish Introduces High Speed, Dual-Spindle Unit

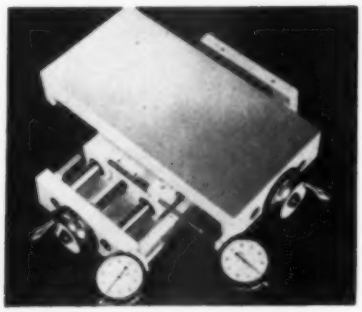
The MM-1-2-HS Mechamatic Machine is a high speed, dual-spindle finishing unit, designed for a multiplicity of parts. It can handle low production of many different parts or high production of a single part.

The parts are mounted on air-operated spindle fixtures which are submerged into a fluid abrasive mass. This mass simulates a form-fitting grinding wheel, regardless of the shape of the part, and travels at approximately 2000 sfpm.

On a 15-second time cycle, the machine will produce 240 pieces per hour per spindle at 100% efficiency. It can handle parts up to 8¼-in. dia. The process is completely automatic except for loading and unloading parts.

Mecha-Finish Corp, Sturgis, Mich

MORE DATA? Circle 84, inside back cover



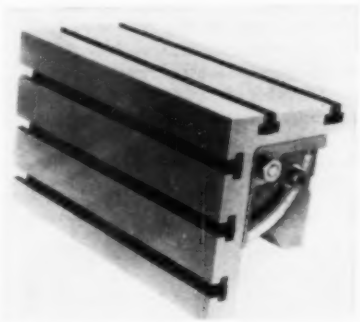
2-Way Precision Compound Minimizes Screw Backlash

Inaccuracies in slide tolerances and backlash in screws and nuts found in conventional dovetail slides are reported to be overcome with this two-way adjusting compound for precision holding and locating of work. Compound was originally developed for holding templets during operation of the Duplimatic tracer control attachments manufactured by the firm.

Dial indicators and adjusting rods, mounted on the unit, compensate for backlash and allow adjustments to tolerances of 0.001 in. Need for precision screws and nuts is eliminated. Slide, which can be adjusted up to 4 in., is mounted on ball bushings with round ways which facilitate easy movement regardless of length.

Tracer Control Co, 595 E Ten Mile Rd, Hazel Park, Mich

MORE DATA? Circle 85, inside back cover

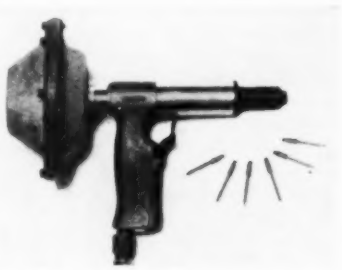


Adjustable Angle Plate Designed for Heavy Duty

Model 160 has two T-slotted plates, one 8 x 18 in., the other 10 x 18 in. Top plate is adjustable from 0 to 45°; side plate, 45 to 90°. Over-all height of the tool is 8-¼ in. Top plate has three 11/16-in. T-slots, side plate has two. Side quadrant is fully graduated for ease of setting. All working surfaces are ground square and true. Heavy-duty bolting insures extremely rigid setups.

Universal Vise & Tool Co, Parma, Mich

MORE DATA? Circle 87, inside back cover



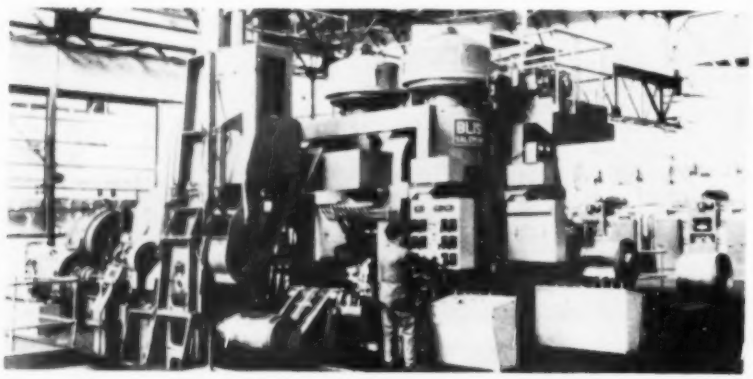
Lightweight Riveting Gun Works on Compressed Air

Pneumatic gun called the Texan is designed to pull nearly all sizes and types of Pop rivets including the new closed-end Imex recently introduced. Tool will work off compressed air having a pressure as low as 60 psi or as high as 90 psi. Peak efficiency is reportedly maintained even when air hose is as long as 60-70 ft. Stroke is ⅝ in. and the pulling force nearly 1000 lbs.

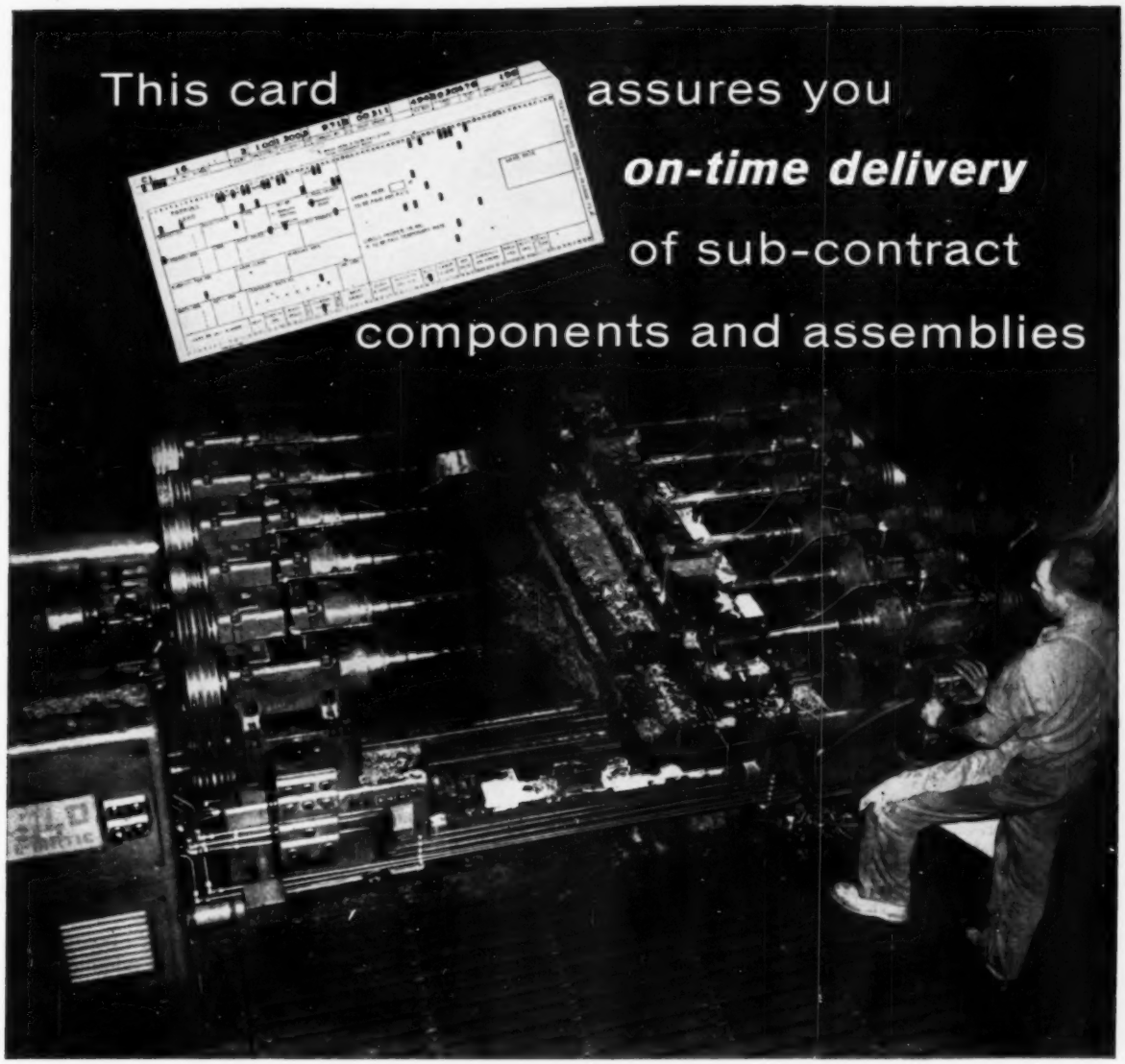
Features include extremely fast-acting cycle which sets the rivet when the gun is triggered; adaptability to rivets with shank diameters up to ⅛ in. in steel or aluminum. Unit weighs less than 4 lbs, is priced under $100.

Pop Rivet Division, United Shoe Machinery Corp, Boston, Mass

MORE DATA? Circle 88, inside back cover



FOUR HIGH REVERSING COLD MILL, built for Compagnie Francaise des Metaux, is a 6½ in. and 30 x 36-in. unit that rolls brass strip 30 in. wide down to 0.0028 in. Max speed is 1000 fpm with back-up roll drive—*E W Bliss Co, Rolling Mill Div, 250 Franklin St, Salem, Ohio* MORE DATA? Circle 86, inside back cover



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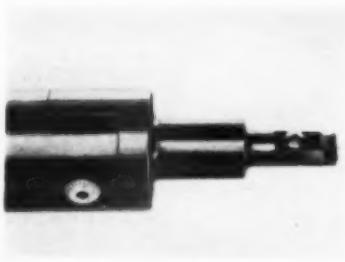


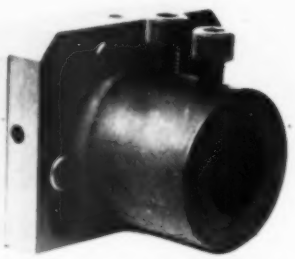
Small-Hole Boring Bar Has Interchangeable Head

Micro-adjustable boring bar can carry interchangeable heads for boring holes from ½ to 1½-in. dia. Each head can be adjusted to cut up to a ½-in. larger diameter so that it is possible to cover the complete range with four heads. In addition, each head can be adjusted slightly undersize so that some holes less than nominal size can be bored.

Because length-to-diameter ratios of boring bars are critical these bars will be stocked partially finished. Heads will be finished to required lengths for specific applications. Interchangeable heads can be completed to use either triangular or square carbide throwaway inserts.

Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich

MORE DATA? Circle 89, inside back cover



Adjustable Flanged Toolholders Fit All Makes of Turret Lathes

Line of toolholders has been introduced for mounting directly on the turret face. Once adjusted to the centerline of the spindle they may be left in place on the turret. In older machines, need for floating toolholders is eliminated.

Unit consists of two parts — the base, which is centered on the face of the turret by a short pilot and bolted to the turret, and the adjustable member which is aligned with the spindle by four small adjusting screws and then locked to the base. It may be used with or without bushings to hold tools such as drills, reamers, and boring bars. Bore of the toolholder is machined accurately to size and base is machined for precision alignment. Holders are available for Warner & Swasey machines No. 3, 4, 5, and 6 and will also fit comparable sizes of Gisholt, Jones & Lamson, and other popular turret lathes. Bore sizes are 1½ in. and 1¾ in.

Gahr Machine Co, 19199 St Clair Ave, Cleveland 19, Ohio

MORE DATA? Circle 90, inside back cover

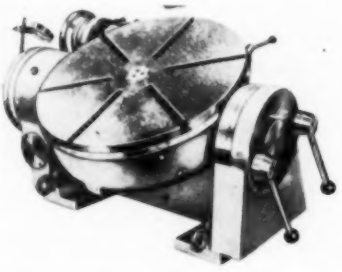
Edco Announces New Line Of Forge Die Sinking Cutters

New line of cutters is made of a new type of steel with special heat treating for maximum performance in harder, tougher forge die blocks. They have a Rockwell hardness of C-66-67, yet, according to the manufacturer, there is far less chipping or breakage than experienced with tools used previously.

Line includes angle cutters, ball cutters, roughing cutters, end mills, tool bits and rectangles, and carbide burrs. Special tools can be produced to specification.

Edco Tool Co, 93 Oak St, Wyandotte, Mich

MORE DATA? Circle 91, inside back cover



INCLINABLE TABLES made in West Germany are available in six sizes, ranging from 10 to 32 in. dia. They can be used for jig boring, assembly, and inspection. A circumferential cam provides indexing accuracy of 10 seconds of arc—*Opto-Metric Tools, Inc. 137 Varick St, NY 13, NY*

MORE DATA? Circle 92, inside back cover

Really Tough Where the Power Hits the Ground—thanks to TOCCO* *Induction Heating*

The Eimco Corporation of Salt Lake City manufactures heavy-duty earth moving and mining equipment of many kinds. All of their equipment must be engineered for tough work in the roughest kind of terrain, and all of it runs on tractor track that must stand up to the toughest abuse.

Superior Quality

Recently Eimco installed a 100 kw, 10,000 cycle TOCCO machine for heat treating track links. This equipment assures a completely uniform hardness pattern—the same every time for one link or one million. Furthermore, the parts are drawn as well as hardened by one TOCCO machine with one operator.

Increased Production

In addition to superior quality, TOCCO increased track link production over 400%. Formerly, one man could produce 35 links per hour; now, with TOCCO, he produces 150!

Whether you're looking for product improvement, increased production, or lower unit costs, it will pay you to investigate TOCCO Induction Heating.

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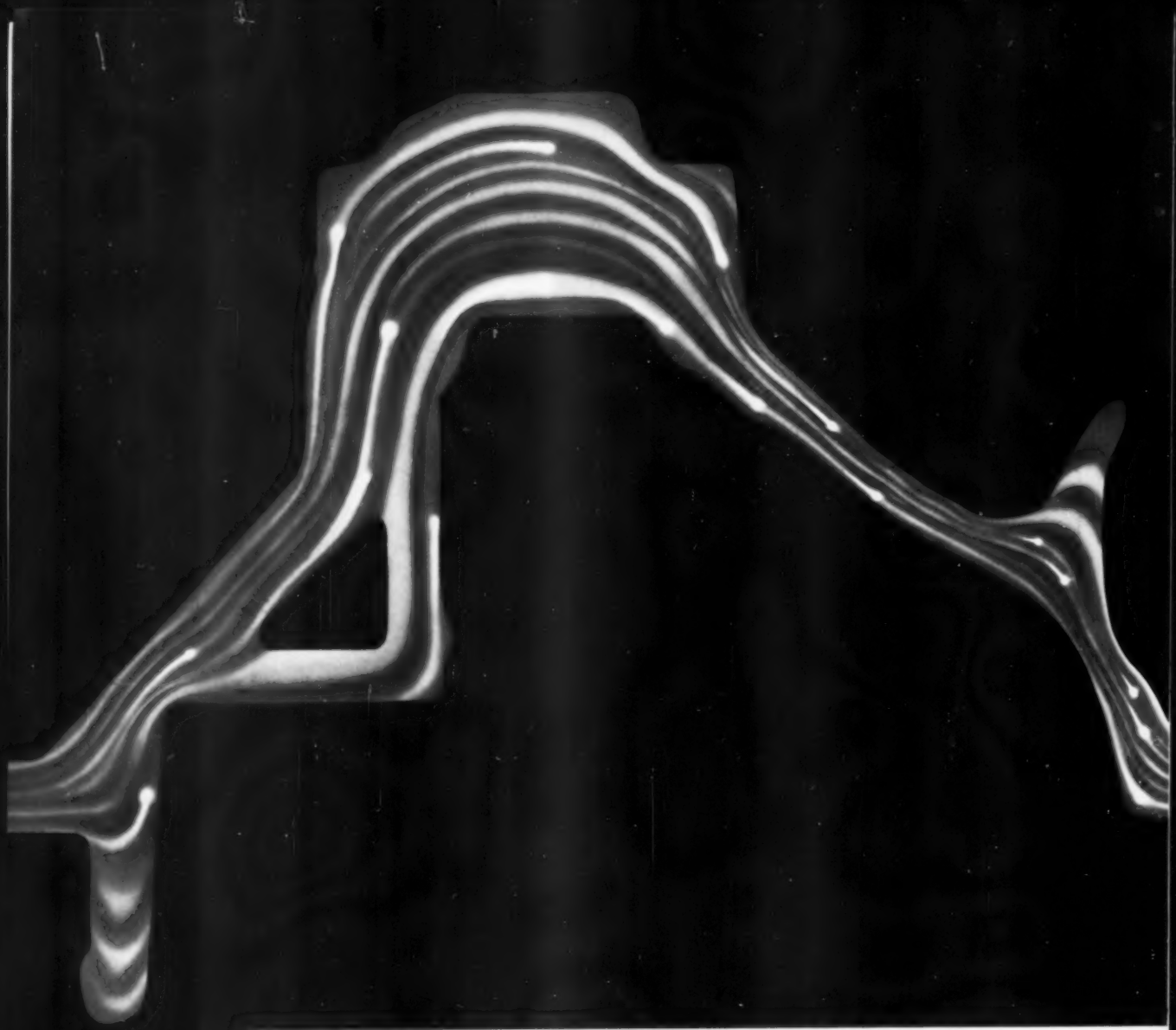


Fluid mapper pattern demonstrating liquid flow through a cross section of a Malleable differential carrier.

Versatility is Malleable

The ability to do most any job well is synonymous with Malleable iron castings. The variety of tasks they perform, from the commonplace to the spectacular, is legend. The strength and toughness . . . the freedom of design . . . the wide range of shapes and sizes . . . the excellent machinability . . . the economies achieved . . . all these advantages of Malleable combine to create an unexcelled reputation for versatility.

Whatever your needs, look first to Malleable.

For information or service, call on one of the progressive firms that identify themselves with this symbol—

MEMBER
MALLEABLE
CASTINGS COUNCIL

If you wish, you may inquire direct to the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio, for information.

Versatility Is Key to Malleable's Increasing Use

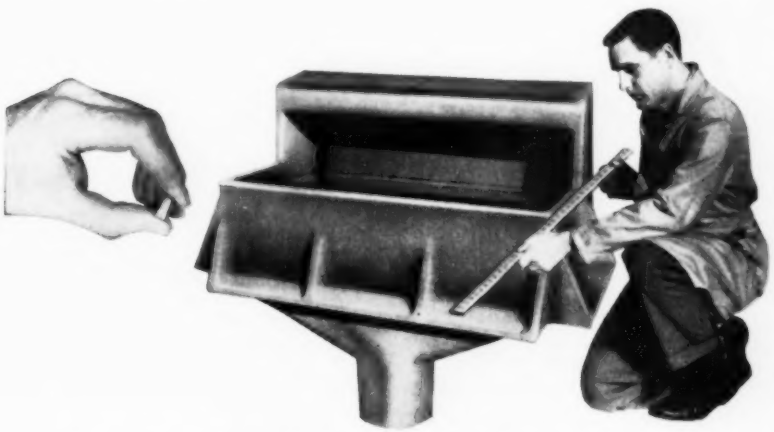
Recent metallurgical advances have made the Malleable irons a family of metals uniquely capable of meeting the most diverse design, production and performance requirements. Whether the vital consideration is high strength, toughness, ductility, hardness, machinability, high or low temperature performance, wear resistance, or economy and adaptability for complicated designs, Malleable castings have the versatility to meet exacting specifications.

For versatility of shape, the casting process is unexcelled. It permits direct production of the most complicated components. The metal is placed exactly where it is needed regardless of the intricacy of the design.

The capabilities of the metal to be cast are of even greater significance, for every application has a different set of requirements. Here, Malleable iron provides unique opportunities to obtain better parts at less cost.

Holes can be punched in Malleable, surfaces can be coined to meet rigid specifications. The pearlitic Malleables can be surface-hardened for even better wear resistance. These and other advantages make today's Malleable iron one of the most versatile engineering materials available.

Although Malleable iron's properties are flexible, depending on service requirements, certain relationships remain constant. Malleable provides more strength and toughness per dollar than any other metal. It is also the most machinable of all ferrous metals of similar properties.



Malleable castings can be produced in sizes ranging from the hammer handle wedge, shown here, weighing less than an ounce, to the 1,125 pound bridge scupper. Throughout this range is an endless variety of castings, best made of Malleable for highest quality at lowest cost.

Shapes and sizes of Malleable castings are virtually limitless. The combination of Malleable's good castability with modern production techniques regularly results in sections as thin as 1/16" and tolerances of ±.005" per inch in sections of 1", with excellent surface finishes.

Engineering Aids Available

While the design of Malleable castings is not complicated, it will pay you to consult a skilled Malleable engineer who can offer time and cost saving suggestions for the production of better parts. As another aid to basic Malleable casting design, a special folder — *Data Unit 104 — Design Versatility* — is available from any member of the Malleable Castings Council and from the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

These companies are members of the

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Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
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Wagner Castings Company, Decatur

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MINNESOTA
Northern Malleable Iron Co., St. Paul 6

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW JERSEY
Meeker Foundry Company, Newark 4

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Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
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Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
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Lancaster Malleable Castings Co., Lancaster
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Texas Foundries, Inc., Lufkin

WEST VIRGINIA
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Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

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FIELD REPORT...

Ring Punch & Die, Inc . . .

. . . Jamestown, NY, has become a division of Producto Machine Co, Bridgeport, Conn. Ring operations will continue in Jamestown; C Ernest Larson and Emil M Johnson, former officers of the company, have been made vice presidents of Producto. Producto, a leading manufacturer of diesets, toolroom accessories, and machine tools, has for the past ten years sold the nationally distributed Ring line of standard and special punches, dies, and retainers.

General Dynamics Merger

Directors of General Dynamics Corp and Material Service Corp have approved merger of the two companies. MSC, one of the nation's largest producers of building materials, concrete products, and coal, will become a major division of Dynamics which is engaged in a long-term program to supplement its defense business with expanding commercial operations.

AMF Sets Up in Australia

American Machinery & Foundry Co has joined forces with two Australian business enterprises to form a new company known as AMF Sterling Ltd. AMF partners in the new operation are the British Tobacco Co (Australia) Ltd, and Walter and George Andrews, former owners of Sterling Machinery Pty Ltd. Latter firm, now absorbed into AMF Sterling Ltd, has been manufacturing automatic machinery for the baking industry since 1935; it's been producing AMF bakery equipment under license since Jan 1958.

(continued on p150)

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Field Report . . .

New company, with executive offices and plant in Sydney and a branch sales office in Melbourne, will manufacture a complete line of bakery machinery and other AMF products. Association with the British Tobacco Co will facilitate development and production of tobacco machinery and spare parts for customers in Australia and the Far East.

Gros-ite Licenses Belgian Firm

Gros-ite Industries, Farmington, Conn, has concluded an agreement with Ateliers T Hanrez, Monceau-Sur-Sambre, whereby the Belgian firm has exclusive rights to manufacture and sell the Roy screw slotting machine to all countries outside of the US and Canada. Hanrez will add the line to its machines now being produced for the bolt and nut industry.

Lockheed Building for New Div

Administrative and scientific headquarters for the recently established Lockheed Electronics and Avionics Division (LEAD) will go up on a 200-acre site on the outskirts of Newport Beach, Calif. The plant in Los Angeles where LEAD has temporary headquarters, will be retained as a manufacturing facility for the division. Company expects to occupy the Newport Beach quarters during the late summer of 1960. Initial construction at the new site will house a workforce of 1000 employees.

$8 Million Order to Autonetics

Autonetics, a division of North America Aviation, has received an $8 million contract from Lockheed Aircraft, Burbank, Calif, for electronic armament control systems for installation in Lockheed's F-104G Starfighters recently ordered by the Republic of West Germany.

US Metal Plants in Puerto Rico

The 100 US branch plants manufacturing metal products in Puerto Rico are listed in a new directory of 600 Operation Bootstrap factories now in production on the island. PR'S US affiliated metalworking industry has grown from a handful of plants in 1950 to approximately 100 that ship annually $44 million worth of its production to the continental US and $12 million to other nations. Directory lists US metalworking affiliates under these categories: name and address of plant; product; date of

start of operations; name of executive in charge. It can be obtained from the Economic Development Administration of Puerto Rico, 666 Fifth Ave, New York, 19, NY.

Colonial Offers Broaching Service

Colonial Broach & Machine Co, Detroit, has made production broaching facilities available to industry in the area. Services include broaching short runs for manufacturers whose requirements do not warrant purchase of machines; experimental production work to aid manufacturers prior to re-tooling programs; supplementing needs of manufacturers who are waiting for delivery of equipment. Colonial's equipment includes both vertical and horizontal machines designed for both internal and surface broaching. Department is provided with a stock of selected standard round, keyway, and spline broaches.

Radiation, Inc . . .

. . . Melbourne, Fla, manufacturer of telemetering systems, is building a $4 million plant at Port Malabar, Fla. Facility will include 20 buildings by 1965.

Industry in the South

Anchor Metals, Inc, Hurst, Texas, engineer and fabricator of galvanized steel transmission towers and substations for the electric utility industry, is setting up operations in Anniston, Ala. Facility will employ 100 workers initially, may up figure to 350 later.

New Alabama metalworking concerns formed during the first half of

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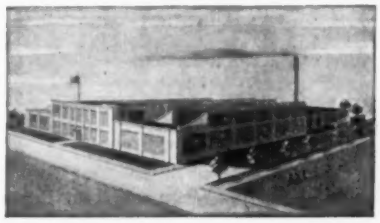

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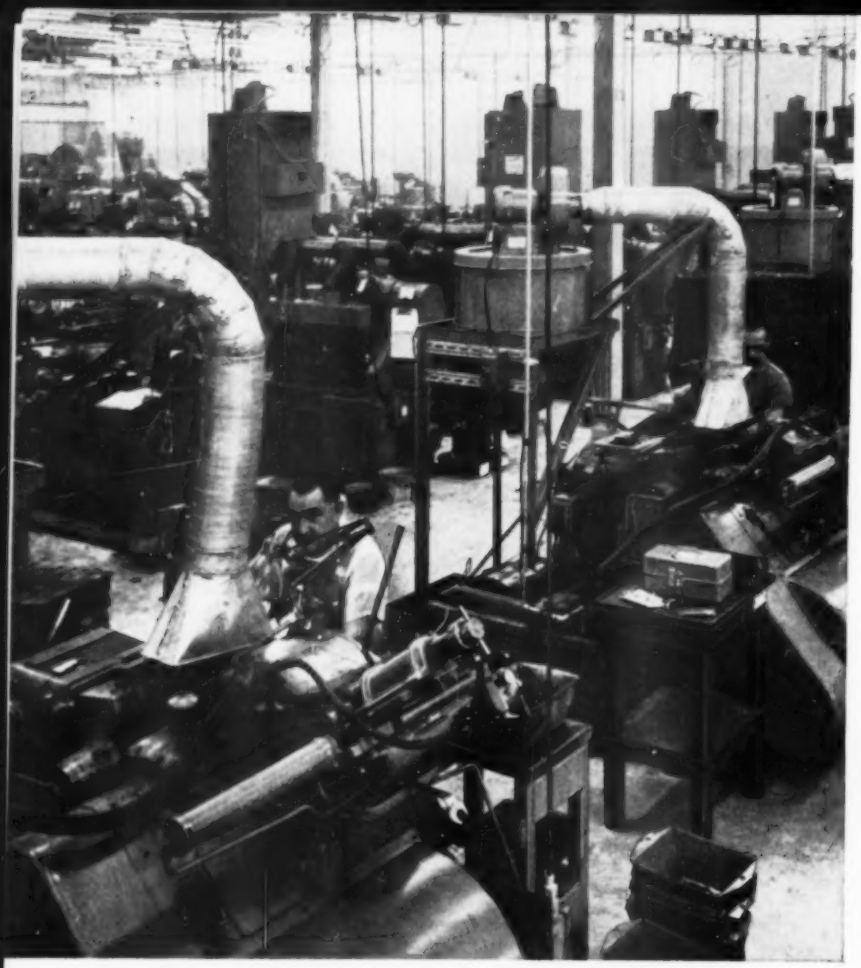

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ALLEN

A quarter of a million square feet of space in the great new Allen plant is devoted to precision fasteners – and much of it houses batteries of the latest, high-speed automatic centerless grinding equipment. Here you see a close-up of the grinding section set up to produce dowel pins at the rate of one a second per machine.

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ALLEN HEX SOCKET SCREWS HEAD

Field Report . . .

1959 include Alabama Steel Fabricators, Inc, Oneonta; Whitman Trailers, Inc, Elba; Permanent Machine & Tool Co, Florence; L & M Tool and Machine Co, and Ranzan Sash & Door Co, both of Athens; and J F Carmichael Tin Shop, Montgomery. Companies that have expanded facilities during the past six months: Dorsey Trailers, Inc, Elba; Bluff City Sheet Metal Works, Eufaula; Bagwell Steel Co, Bessemer; C E Sawyer Industrial Sheet Fabricators; Connors Steel, Division of H K Porter Co; and Vulcan Metal Products Co, all of Birmingham.

Martin Gets New Lacrosse Order

Army has placed a new contract with Martin Co, Baltimore, for additional missiles of the Lacrosse type, plus engineering services. New order, for $15.1 million, brings Martin's total contracts to date for the weapon to $25.1 million.

$19 Million Order to Vertol

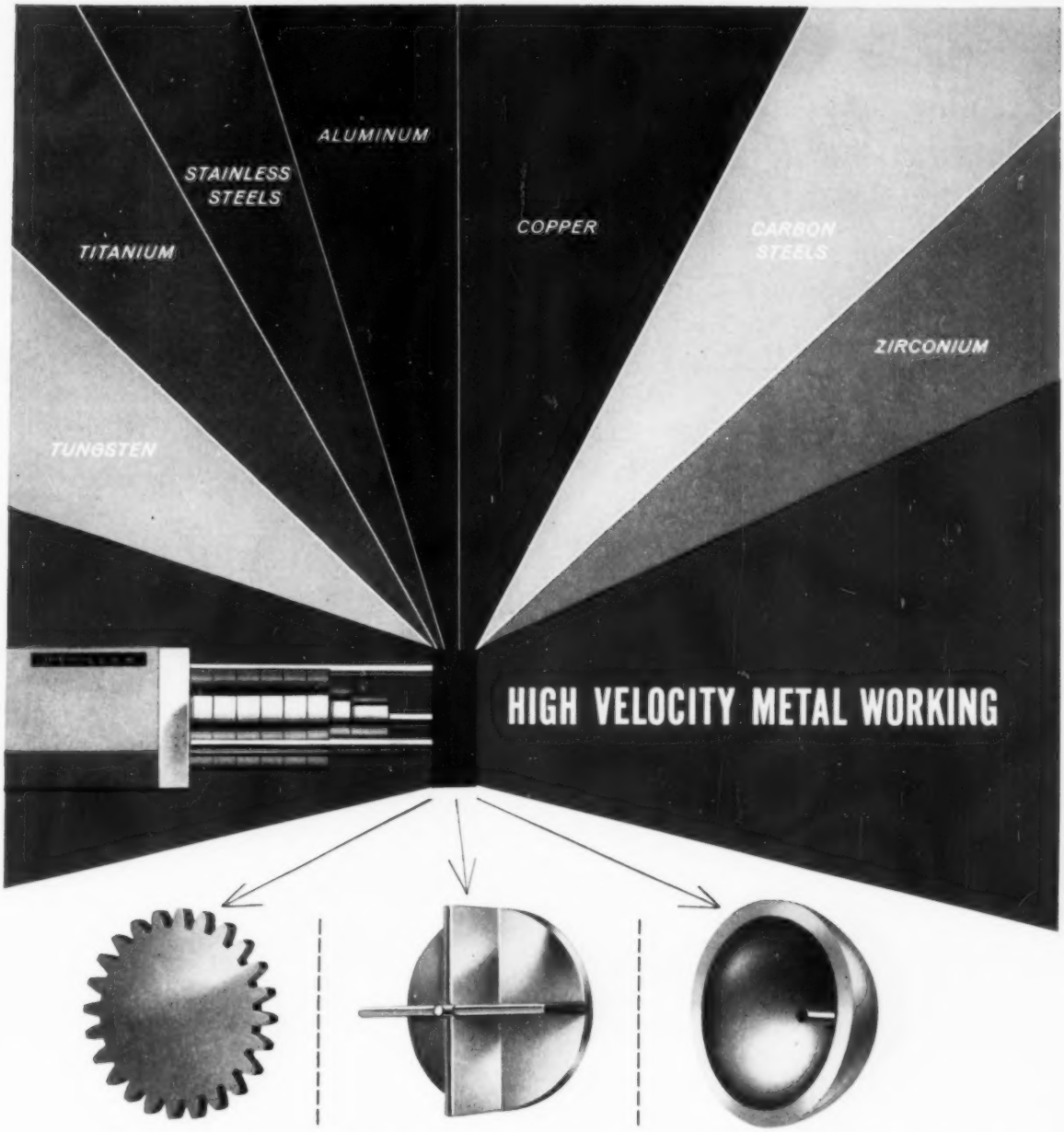
Vertol Aircraft Corp has a $19 million military letter contract for production of five turbine-powered transport helicopters, the YHC-1B.

Zinc Die Casting Plant Opened in Florida

New zinc alloy die casting plant has been opened in Miami. The Southern Die Casting Co will specialize in castings up to 2 lbs for a variety of industrial end uses. Plant operations include custom mold and die making, casting, wet and dry tumble finishing, plating, and complete testing and inspection facilities. It's also equipped to produce one-cavity molds for pilot runs of new items.

The smuggler and the border guard. . ."

CIRCLE 263 READER SERVICE CARD



DYNAPAK—A NEW DIMENSION IN DESIGN AND PRODUCTION OF METAL PARTS

The ability of DYNAPAK high velocity metal working machine tools to forge, form or extrude intricate shapes to precision tolerances from common or high strength metals, offers new solutions for complex problems of design and manufacture.

THE DESIGN ENGINEER will find a new degree of freedom in design. He is no longer confined by the limitations of conventional forming techniques. He can now more nearly specify the ideal materials, shapes, and tolerances.

THE PRODUCTION ENGINEER can often accomplish, in a single operation and with simplified tooling, what would otherwise require multiple operations and complex tooling. With DYNAPAK, management can realize a substantial long-term advantage in capital investment.

Arrange today to evaluate DYNAPAK for your metal working operations. Write, wire or phone

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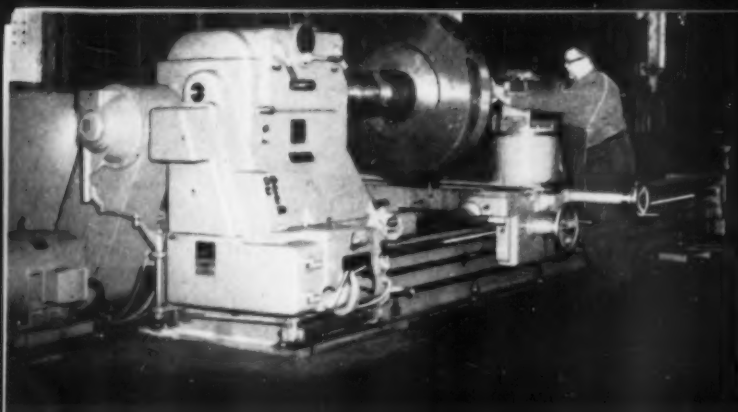
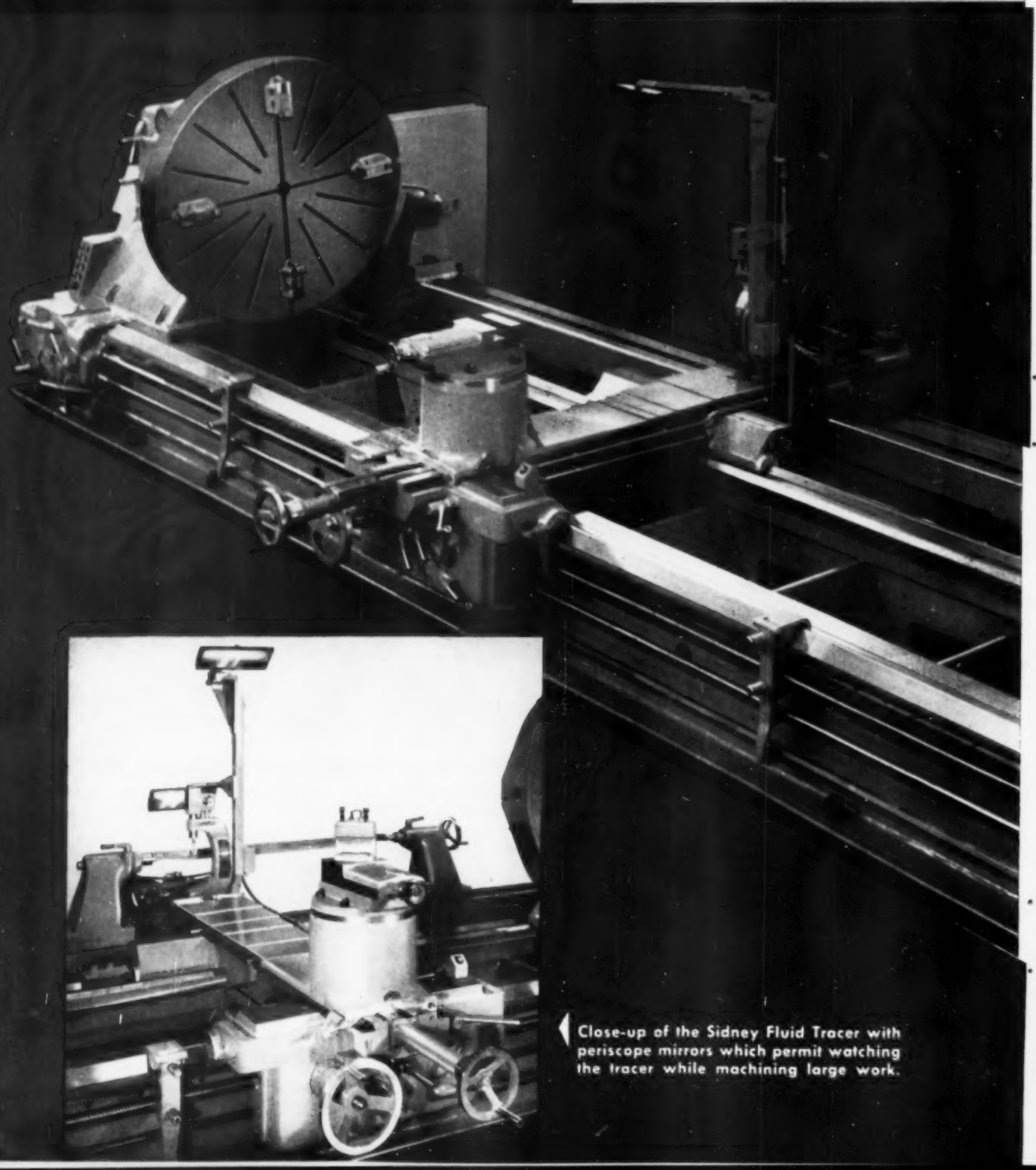
CIRCLE 265 READER SERVICE CARD ►

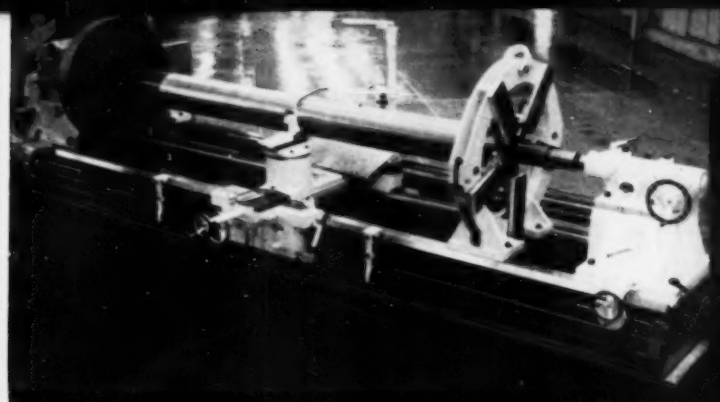


A large missile component being tracer-machined at a major West Coast missile plant on a Space-Master with 60" swing and 21' centers.

This Sidney Space-Master is contouring steel rolls up to 50" diameter to close tolerances.

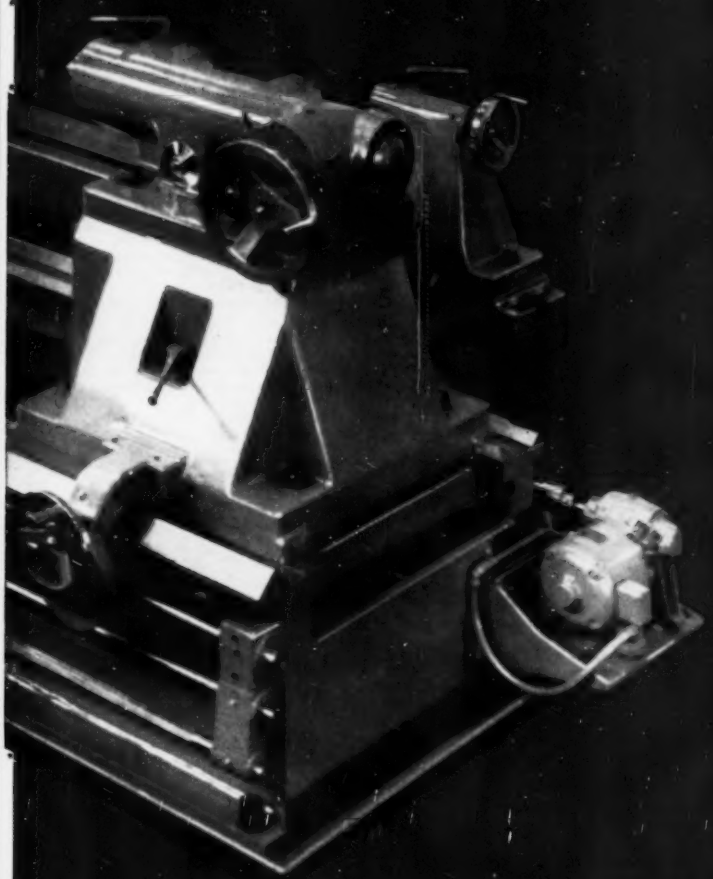


Close-up of the Sidney Fluid Tracer with periscope mirrors which permit watching the tracer while machining large work.



Introducing the SIDNEY SPACE MASTER©

for high precision on large parts



With swings up to 72 inches and center distances up to 51 feet, the Sidney SPACE-MASTER© is the answer for those manufacturers looking for precision on large MISSILE AND ROCKET PARTS.

Available with or without the Sidney Fluid Tracer, the Space-Master is full of precision-insuring and time-saving features. Here are some of them:

- **Lapped herringbone gear headstock**
- **60 thread and feed changes**
- **Powerful rapid traverse**
- **Double-walled apron**
- **Massively bridged bed**
- **Large support areas throughout for carriage, slide, tailstock, etc.**
- **Heat-treated lathe rack**
- **Graduated dial to measure tailstock spindle travel**
- **Honed tailstock bore**
- **Anti-friction bearings**
- **Periscope mirrors for Tracer when machining large parts**

If you want to speed output, hold your tolerances down (to ± .001) and cut your cost, it will pay you to look into the Sidney Space-Master. Ask for Bulletin #S-600.

SIDNEY MACHINE TOOL CO.
SIDNEY, OHIO
Wholly owned subsidiary of Buhr Machine Tool Co.

Want to know 116 different ways to join a piece of welded steel tubing to another tube or to other parts? Send for 16-page, illustrated special report from American Machinist:

The Production Man's Guide to

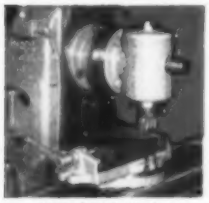
JOINING WELDED STEEL TUBING

Send 35c for each copy wanted to:

READER SERVICE DEPARTMENT

American Machinist

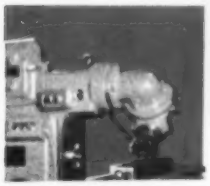
330 West 42nd Street, New York 36, N. Y.



Heavy Duty Vertical Milling Attachment

Heavy Duty Offset Vertical Milling Attachment

Universal Milling Attachment



Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

GREAVES MILLS

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS.
Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.

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Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.
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Send coupon for FREE Comparison Chart and detailed descriptive literature on easy-to-use attachments.

CIRCLE 267 READER SERVICE CARD

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 TURRET DRILL—*Burg Tool Manufacturing Co, 15001 S Figueroa St, Gardena, Calif.* 6-page illustrated bulletin covers improved Burgmaster 1 C 6-spindle hand-feed model. Features include power indexing turret with 12 pre-selective spindle speeds from 325 to 4050 rpm; pre-selective, precision depth control. Optional tooling accessories and equipment described.

2 UNIVERSAL GRINDER — *Landis Tool Co, Waynesboro, Penna.* 16-page catalog S-59 describes and pictures the 12 x 28-in. Grindwell, a general purpose precision cylindrical machine for use in small lot manufacturing in both large and small shops. Illustrates variety of grinding operations that can be performed; includes specifications, plus list of standard and extra equipment.

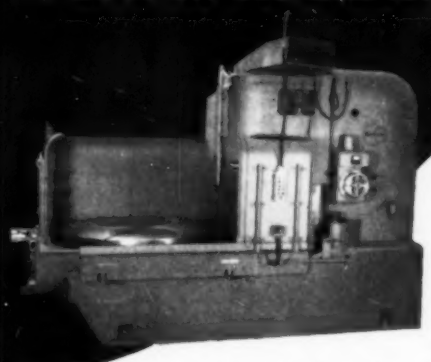
3 SINGLE-SPINDLE BAR AUTOMATICS—*Cleveland Automatic Machine Co, 4932 Beech St, Cincinnati 12, Ohio.* 4-page illustrated bulletin B-359 gives detailed description and specifications of newly designed 1⅝ and 2½-in. capacity Model B and Model B-18 in. automatics (not turret-type machines). Tooling is mounted on a flat end-working slide, capable of turning several OD's in addition to performing one end-working operation. Front and rear cross-slides provided for additional turning and forming work. Model B can feed stock to 10¼-in. length; Model B-18 in. to 19½ in.

4 PRESS BRAKES—*Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* 12-page bulletin 90 contains full information on redesigned, expanded line of Series IB, 15, 30, and 60-ton machines. Features described include enclosed inboard design with wrap-around crown; adjustable speed drive; manual and power ram adjustments. Specs given for eight models with bed lengths ranging from 4 to 14 ft and with mild steel bending capacities to 3/16 in.

5 TOOLING WITH STANDARD POWER TOOLS—*Rockwell Manufacturing Co, Delta Power Tool Division, 4N Lexington Ave, Pittsburgh 8, Penna.* 66-page Delta Blue Book presents 65 illustrated case histories that tell how Delta tools are used in combination with other tools, with automatic controls, and in special setups to combine operations, to automate operation, and to perform operations usually done on more expensive, special-purpose machines.

"Sorry—vibration absorption pads going under that machine."

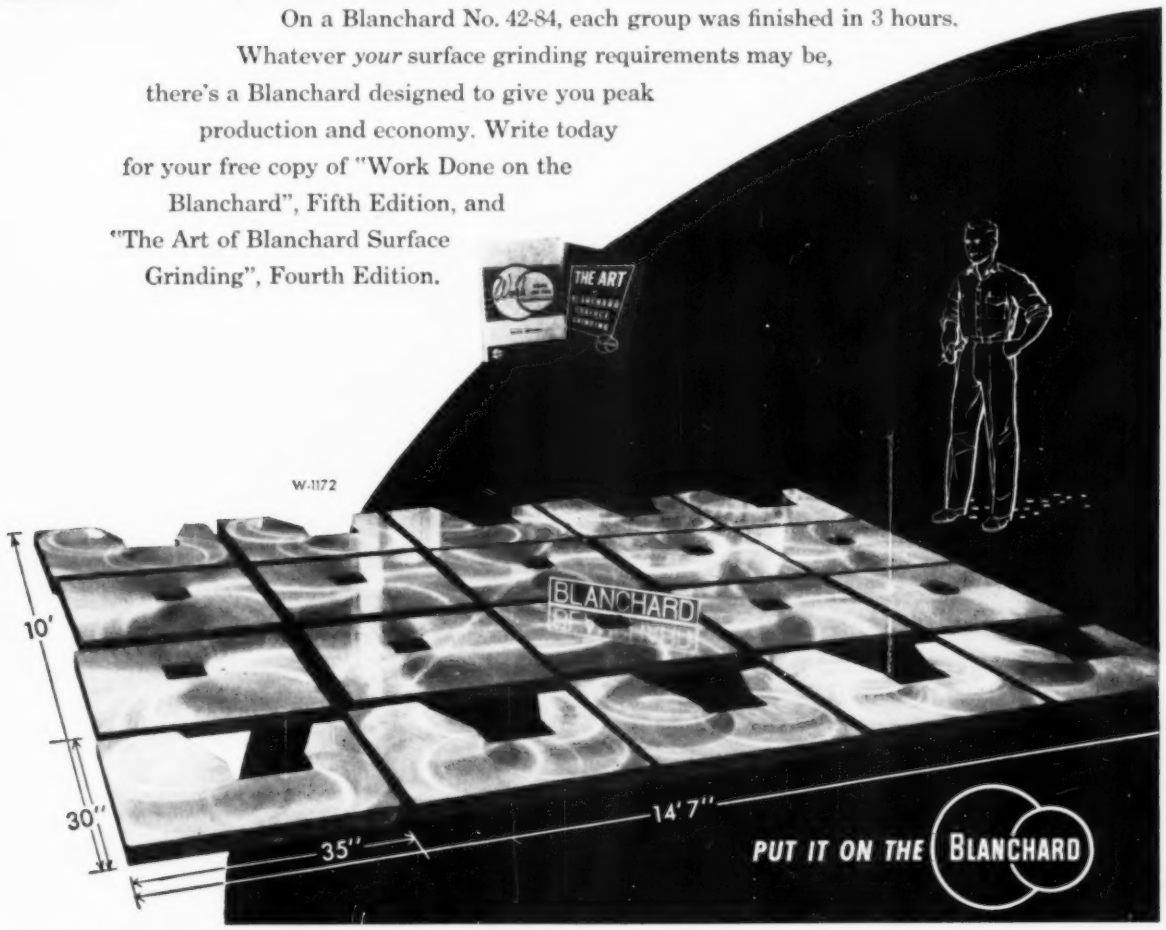
Grinding Perfection is Assured When You "Put it on the Blanchard"



V-517

The production speed and precision of modern Blanchard Surface Grinders are illustrated by this interesting job, involving 20 plates measuring 30″ x 35″ x 3″. Ten of them had openings of 6½″ x 4″, the other ten had openings of 11″ x 20″. Each group of plates required stock removal of $\frac{5}{32}$″ from two sides, with flatness of .003″. On a Blanchard No. 42-84, each group was finished in 3 hours.

Whatever *your* surface grinding requirements may be, there's a Blanchard designed to give you peak production and economy. Write today for your free copy of "Work Done on the Blanchard", Fifth Edition, and "The Art of Blanchard Surface Grinding", Fourth Edition.



W-1172

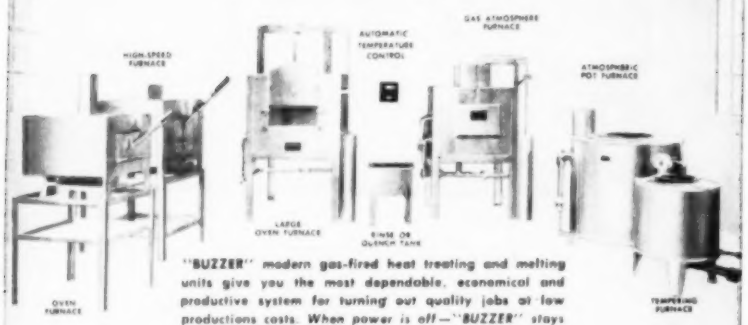
THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

MORE HEAT TREATING VOLUME

with BASIC "BUZZER PACKAGE"

NO BLOWER OR OTHER POWER NEEDED

. . . just connect to gas supply



"BUZZER" modern gas-fired heat treating and melting units give you the most dependable, economical and productive system for turning out quality jobs at low productions costs. When power is off—"BUZZER" stays on the job! Standard and special furnaces, large or small, available to equip your shop to exact requirements.

COMPLETE LINE OF BUZZER REG. U.S. PAT. OFFICE BURNERS FOR CLEANING, RINSING, PICKLING AND SUNDRY HEAT OPERATIONS

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HEAT TREATING EQUIPMENT SPECIALISTS SINCE 1911

CIRCLE 269 READER SERVICE CARD

NEW

AUTOMATIC TAPPER

- NO SKILLED OPERATOR REQUIRED
- ADJUSTABLE TORQUE
- SAVES UP TO 90 PER CENT ON TAP BREAKAGE

Yes, and in addition, production time reduced to 1/10th that previously required by the drill press method was reported by a leading West Coast electronic component manufacturer. This is the story of the Milman Multiple Pitch Automatic Leadscrew Tapping Machine. A small, high speed, sensitive tapper that can be operated by an unskilled operator or incorporated in an automatic manufacturing line, it will handle all the small hole problems encountered in the manufacturing of delicate parts requiring extreme accuracy. It can guarantee class 3 threads. This highly versatile unit, built to instrument standards, can be used in through or blind hole tapping of all thread sizes from 000-120 through 10-32 in all types of workable materials.

Write or call today for more information

MILMAN ENGINEERING CO.

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CIRCLE 270 READER SERVICE CARD

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

Covers tooling problems of all kinds from turning cold rolled steel to producing close-tolerance missile components. Includes dimensional data on tools.

6 HEAVY-DUTY WORK POSITIONER—*Boesch Manufacturing Co, Danbury, Conn.* 4-page bulletin illustrates and describes the PM-1051, a 2000-lb capacity, fully powered machine that provides quick, precise positioning of heavy, complicated, and/or odd-shaped weldments of titanium and other super-alloys. Work may be tilted through a vertical arc of 105° and rotation speed is continuously variable from 0 to 4 rpm in either direction. Pushbutton control is provided for all operations. Features include positive stops on vertical travel, dynamic braking, cast frame.

7 SLITTING EQUIPMENT FOR COIL AND SHEET—*Yoder Co, 5500 Walworth Ave, Cleveland 2, Ohio.* 76-page book contains basic information on design, selection, and operation of slitters and slitting lines. Includes detailed time studies and analysis of operating cycles together with specifications, capacity tables, and other data on standardized series of uncoilers, slitters, recoilers, coil cars, and scrap choppers. Illustrated and indexed.

8 PAPER TAPE READER—*Bendix Computer Division, 5630 Arbor Vitae St, Los Angeles 45, Calif.* Illustrated data sheet describes Model PR-2. Used in combination with the Bendix G-15 general purpose digital computer, the photoelectric reader accepts paper tapes punched in any numeric code.

9 MAGNETIC TAPE TRANSPORT—*Burroughs Corp, ElectroData Division, 460 Sierra Madre Villa, Pasadena, Calif.* 4-page brochure describes Model 546. Designed for use with digital computer and control systems, it features vacuum-controlled reel servo system, bi-directional tape speeds of up to 90 in. per second, dual head operation, and rapid start-stop times. Unit has capacity of up to 3500 ft of ½ or ¾-in. tape on 10½-in. reels.

TOOLS AND ACCESSORIES

10 SOLID CARBIDE CUTTING TOOLS—*Rotary Tool Industries, Inc, Dept AM, 4461 W Jefferson Ave, Detroit 9, Mich.* 23-page catalog 359 contains complete specifications on 70 different series including end mills, drills, reamers, and burs. Charts show speeds and feeds recommended for material at various Rockwell hardnesses.

(continued on p161)

"Now this number was owned by an elderly plant with narrow aisles so it was never driven over 8 to 10 miles an hour—"

CIRCLE 271 READER SERVICE CARD ►

TOMORROW'S NEWS GETS A "LIFT" FROM P&H

The newspaper must go out on time! And to start heavy rolls of newsprint into production, this major metropolitan daily relies on the finest hoists in the world to keep things moving . . . new Balanced-Design P&H Hevi-Lifts.

Balanced Design means that each part of the new P&H Hevi-Lift hoist has been balanced or matched with every other part for maximum strength, temperature, and performance characteristics. *There are no weak parts!*

Even under severe duty cycles — motor, gearing and brakes continue to function at top efficiency without excess heating or abnormal wear. In short, *Balanced-Design Hevi-Lifts will stand up longer under heavier duty cycles — with less maintenance — than any other hoist made today!*

If you can't afford "second chances" in your materials handling, write today for Bulletin H-55 and take a long look at the complete line of Balanced-Design P&H Hevi-Lifts. It's yours for the asking from Dept. 206, Harnischfeger Corp., Milwaukee 46, Wisconsin.

P&H HARNISCHFEGER
...quality and service for 75 years

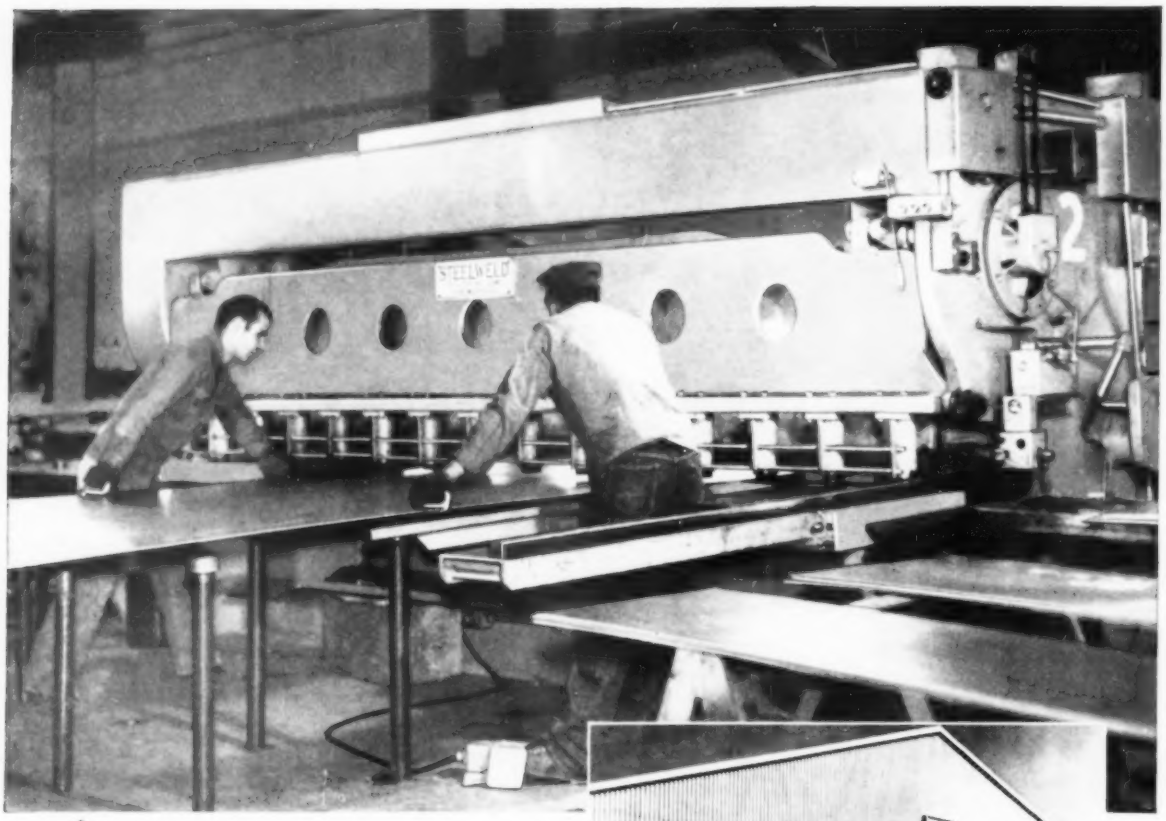
OUR 75TH YEAR

Photo Courtesy New York NEWS

STEELWELD SHEAR

Operates 16 Hours a Day

Cuts Components for Prefabricated Buildings



Cutting and slitting operations normally keep this Steelweld Shear busy 16 hours a day. It is equipped with Steelweld's popular Micro-Set Knife Adjustment. This permits adjusting the knife clearance to suit the thickness of metal being cut in the matter of seconds. Thus, the finest cuts are assured for every shearing job.

A recent Pascoe Building.

RAPIDLY forging ahead in the prefabricated steel building field, Pascoe Steel Corporation, Pomona, California, has found its Steelweld Shear to be an extremely important factor in maintaining a steady rate of production. A large amount of shearing is required to fabricate several hundred tons of steel per month.

The Shear is normally operated 16 hours a day. It is used for cutting web plates for building columns, rafters and many other building components. About 20 hours a week it is used for slitting. The machine has functioned with very little maintenance. In nearly three years of service, the clutch has never required adjustment.

For the very latest in shears and brakes, mechanically or hydraulically operated, be sure to see what Steelweld has to offer.

Write for free copy of catalog No. 2011

STEELWELD

Mechanical and Hydraulic

SHEARS PIVOTED BLADE

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING COMPANY · 1459 EAST 282nd STREET · WICKLIFFE, OHIO

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

11 LINEAR CONVERSION TABLE—*Babcock & Wilcox Co, Tubular Products Div, Beaver Falls, Penna.* Table, designated TDC 110, in chart form, converts inches and fractions of inches into decimal parts of a foot. It is suitable for many purposes in addition to its application to steel tubing.

12 "MOLDS FOR THE PLASTICS AND DIE CASTING INDUSTRY"—*Liberty Tool & Machine Co, 18 S Twentieth St, Irvington 11, NJ.* Illustrated brochure describes fabricating processes for injection, compression, or transfer molds for the plastic industry, plus tools for die casting.

13 SOLID CARBIDE END MILLS—*Kennametal Inc, Latrobe, Penna.* 12-page catalog 559 covers new line of precision ground, fluted end mills in 15 different styles. Includes table of suggested cutting speeds and feeds for 19 metals and non-metallic materials.

14 CUTTING TOOLS — *Illinois Tool Works, Tool & Instrument Division, 2501 N Keeler Ave, Chicago 39, Ill.* 40-page catalog 105 lists complete selection of Illinite standard end mills and milling cutters, including many new items and sizes of end mills. Each tool described including catalog number and price.

15 MARKING EQUIPMENT — *Acromark Co, 7-13 Morrell St, Elizabeth, NJ.* 13-page catalog (plus 7-page price list) contains illustrated descriptions of steel and metal marking machines and tools; name-plate stamping machines; hand-operated, pneumatic, and motor-driven marking and numbering machines; hot stamping machines for plastics; and ink printing machines for marking metal, plastic, paper, wood, and fiber.

16 METAL CUTTING TOOLS — *Edco Tool Co, 93 Oak St, Wyandotte, Mich.* 10-page catalog 759 pictures and describes tools for the forge die sinker. Includes ball cutters, angle cutters, end mills, roughing cutters, toolbits, midget burs, rotary files, and combination center drills.

17 COIL HOLDERS—*Acme Steel Co, 135th St and Perry Ave, Chicago 27, Ill.* 4-page illustrated folder on uniform feed stitching machine coil holders with a non-tangle, automatic brake, explains advantages of holders for up to 50-lb coils. Includes chart for finding the number of stitches produced per pound of wire depending on size of wire and length of stitch.

18 REED VIBROMETER—*Korfund Co, 48-39B 32nd Pl, Long Island City 1, NY.* Illustrated bulletin K14A describes instrument which accurately measures and indicates frequency and amplitudes of vibrations. It is used for tracking down sources

"What's a 'fragile'?"

WORKS *like a charm*

Clover Coated Abrasives, like any other tools, really do no work at all by themselves; but they have a way of lasting, through use and abuse, that makes many a craftsman think of Clover as a partner.

There are good reasons for this lasting quality. First of all, every Clover Coated Abrasive is made to meet the standard of the best in its class. Second, the Clover line is complete—you can find a Clover Coated Abrasive item that is made for your job.

Ask for the new Clover Catalog to get acquainted with our full line of working-partner abrasives.

Clover Manufacturing Company

Norwalk, Connecticut

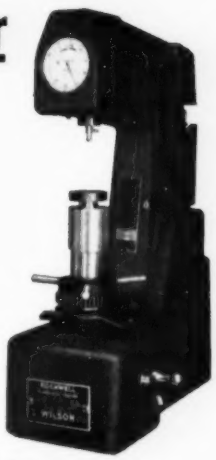
Victor 7-4515

Since 1903

Makers of the famous **CLOVER** Grinding and Lapping **COMPOUNDS**

CIRCLE 273 READER SERVICE CARD

One of these Wilson "Rockwell" instruments will do your hardness testing job



No matter what your hardness testing requirements are, there's a Wilson "Rockwell" tester to do the job. Choose from this complete selection of hardness testing equipment:

"Rockwell" Hardness Tester—for most hardness testing functions.

"Rockwell" Superficial Tester—for extremely shallow indentations.

TwinTester—Combines functions of "Rockwell" and "Rockwell" Superficial testers.

Semi and Fully Automatic—for high-speed testing, at rates up to 1,000 pieces per hour. Automatically classifies pieces as CORRECT, TOO HARD, or TOO SOFT.

Special Machines—for testing large objects, internal readings, and other unusual applications.

Diamond "Brale" Penetrators—Flawless diamonds, individually calibrated, and highest quality construction assure perfect testing every time.

Write for **Bulletin RT-58**

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

of vibration and noise, measuring machine speed, and to expedite machinery trouble-shooting. The 1-lb hand-held unit has frequency range of 120-15,000 cpm.

HEAT TREATING AND WELDING

19 WELDING MACHINES — *Lincoln Electric Co, Cleveland 17, Ohio.* 6-page illustrated bulletin presents data on operating features, construction details, and applications for new TIG models, said to be the only units that can be used for all manual arc welding jobs: dc manual electrode; ac manual electrode; dc inert gas; ac inert gas. Specifications tabulated.

20 MACHINE CUTTING TORCHES— *Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 12-page catalog, form ADC 880, covers complete line of torches, tips, and accessories. Torches described and illustrated may be selected for use with oxygen and a fuel gas-acetylene, propane, natural, or city—to give accurate flame cuts. Mounted on appropriate machines, they produce straight-line and shape-cuts on steel sheets, plates, bars, slabs, blooms and billets, from ⅛ to 48 in. or more in thickness.

21 WELDING STAINLESS STEEL— *Babcock & Wilcox Co, Tubular Products Div, Beaver Falls, Penna.* 4-page folder TDC 162 provides information on welding B&W stainless Croloy tubing and pipe; data given on welding characteristics of both austenitic and ferritic types. Table included indicates electrodes, preheating and post welding heat treatments to be used in joining the stainless to each other and to dissimiliar metals.

22 WELDING CARBON PRODUCTS MANUAL—*Arcair Co, Box 431, Lancaster, Ohio.* 15-page booklet describes in detail the use of welding carbon products, rods, plate and paste to facilitate welding repair work. Illustrations show basic applications; use of carbon plate rod and paste reportedly eliminates need for many jigs and fixtures, especially on small jobs.

23 TEMPERATURE - HUMIDITY CHAMBERS — *Harris Refrigeration Co, 308 River St, Cambridge 39, Mass.* 4-page illustrated catalog folder describes new series of environmental testing ranging from a 2-cu-ft portable unit up to a 10-cu-ft production testing model.

"There's a right way and a wrong way—and it has nothing to do with who happens to have the best production record!"

24 IMMERSION HEATERS — *General Electric Co, Schenectady 5, NY.* 2-page bulletin GEA-6305A is a selector guide for water, alkaline, or plating-bath heating. Explains how to determine which type to use; how to select thermostats and controls for controlling liquid temperatures; shows typical wiring diagram for thermostat and for magnetic switch controls. Table lists amount of kilowatts necessary to heat liquid to desired temperature in one hour.

PLANT SERVICE EQUIPMENT

25 MATERIALS HANDLING EQUIPMENT — *Lewis-Shepard Products, Inc, 125 Walnut St, Watertown 72, Mass.* 16-page catalog 80-204 describes, illustrates, and gives specifications for rider fork lift trucks, rider tractors, narrow aisle rider electrics, electric powered walkies, and manual equipment.

26 OVERHEAD MATERIALS HANDLING EQUIPMENT — *Cleveland Crane & Engineering Co, Tramrail Division, 1036 E 289th St, Wickliffe, Ohio.* 12-page revised booklet 2008-0, "Engineering and Application Data," covers various types of carriers, cranes, tractors, track switches, grabs, electrification. Detailed studies of track design, peening and stresses are given. Installations illustrated.

27 MODULAR BENCH SYSTEM — *Products For Industry, Inc, 1630 Summer St, Stamford, Conn.* 6-page bulletin 159 illustrates and describes benches which are not limited to fixed dimensions, and are made from standard catalog parts. Called Product-A-Flow, the telescopic members and modular elements can be selected to make any configuration; same parts can be used to reassemble the production line for another products. Four different installations are discussed, plus a layout planning package which can make 34 varied layouts.

28 GLASS-JET PEENING — *Perfecto-Peen, Division of Aero-Test Equipment Co, PO Box 10627, Dallas 7, Texas.* 16-page technical review, PPD-124, describes new process using pure minute glass beads in a slurry solution that not only cold works, stress relieves, and increases fatigue life of metals, but also cleans and improves surfaces in finishes down to 4 mu rms. Typical applications covered.

PARTS AND MATERIALS

29 DEEP-GROOVE BEARINGS—*Hoover Ball & Bearing Co, 5400 S State Rd, Ann Arbor, Mich.* 12-page bulletin 110 provides information on types and sizes of Conrad-type units. Standard-width deep-groove bearings are made in extra light, light, medium, and heavy series. They may be open, equipped with shields or contact seals, and are available with or without snap ring. Deep-groove bearings of cartridge design or with felt seals are also offered. Dimensions, loads, and application data included.

30 PREALLOYED METAL POWDERS —*Vanadium-Alloys Steel Co, Powder Metallurgy Dept, Latrobe, Penna.* 8-page illustrated brochure explains meaning of prealloyed, and lists many types of these metal powders. Typical properties of sintered Vasco steel powders are shown together with photos of parts fabricated. Tooling tips and tool steel recommendations included.

● PYROCERAM MATERIALS—*Corning Glass Works, Corning, NY.* 8-page brochure, third in a series of progress reports, gives general description of the glass-ceramic, plus detailed data on two types. Includes electrical, mechanical, thermal, and chemical properties; effects of high energy radiation of Pyroceram Code 9606; design considerations and applications of both types explained; comparative property chart and new diagram-

Superior spindle is major factor in accuracy of G&L horizontals

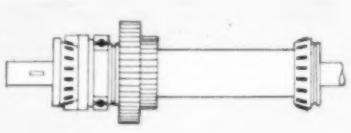
The ability of heavy-duty Giddings & Lewis horizontal boring, drilling, and milling machines to work to jig-boring accuracies on many jobs is made possible by superior spindle construction—and the over-all rigidity and precision of the machines.

Giddings & Lewis spindles ride in ultra-precision Timken 0-33 bearings. These are premium-priced bearings superior to those used in any other horizontal spindle.

Surface finish on Giddings & Lewis spindles averages between two and three microinches. Runout normally measures .0001 to .0002 TIR.

As illustrated in the drawing, the driving gear is shifted close to the front spindle sleeve bearing for slow-speed operation. This minimizes torsional deflection on the spindle. When the heavy drive gear is disengaged for high-speed operation, it provides a flywheel effect, essential for use of carbide tools.

The spindle is accurately supported by the sleeve, ram, and take-



up collet when used in extended position for milling.

When you look at the power and beef that backs up this precision spindle construction, it is not hard to see why G&L horizontals provide exceptional accuracy *and* versatility.

These are some of the reasons why these machines carry the highest trade-in value and the lowest piecework rates of any horizontals available today.

Add to these features use of the building-block principle which gives you more machine for your dollar, and you'll see why G&L is your top buy.

symbol for machining cost reduction

GIDDINGS & LEWIS

HBM-100 T. M.

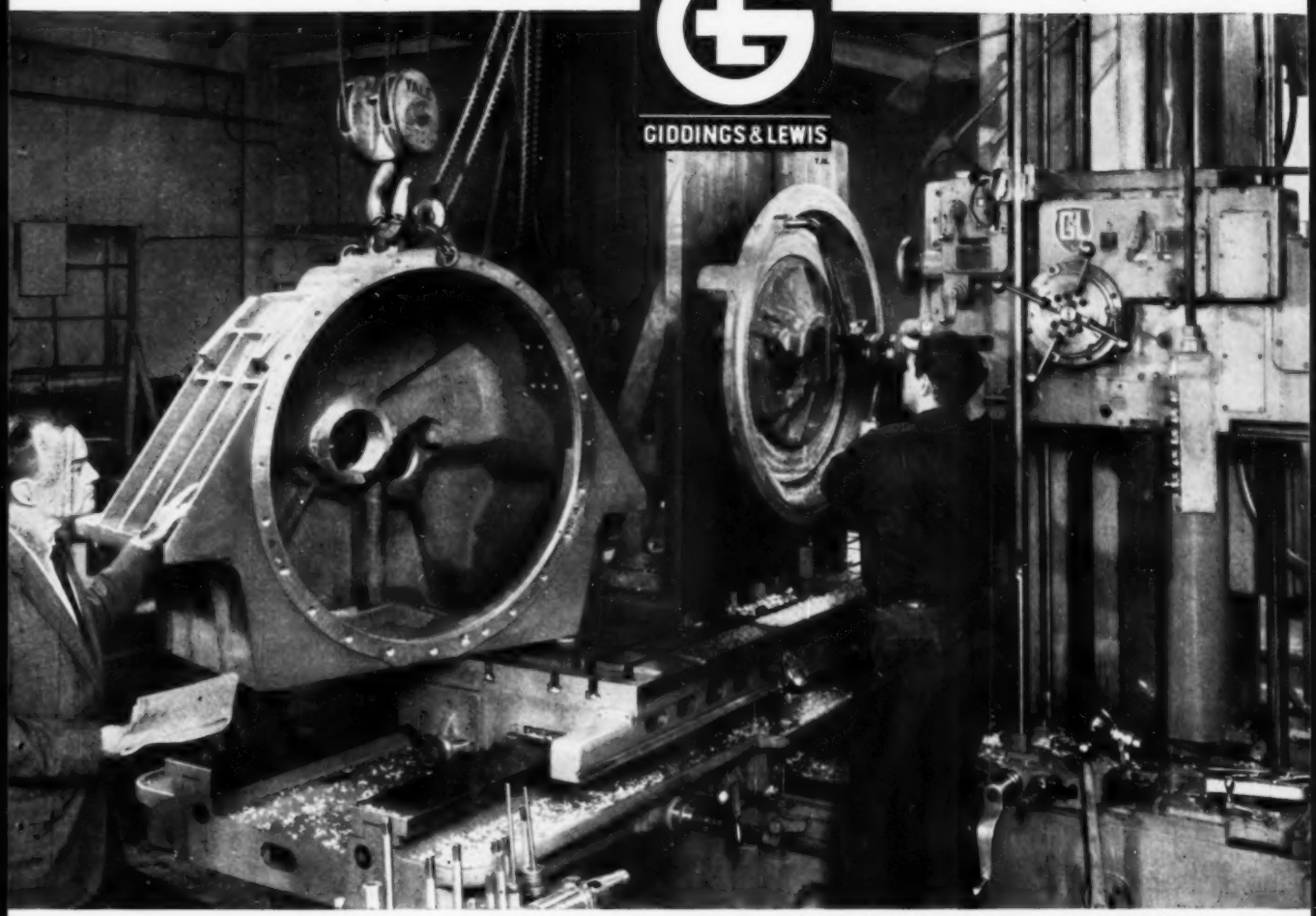


Photo courtesy of Jered Industries, Inc., Hazel Park, Michigan

G&L: for "tenths" accuracy on jobs like this

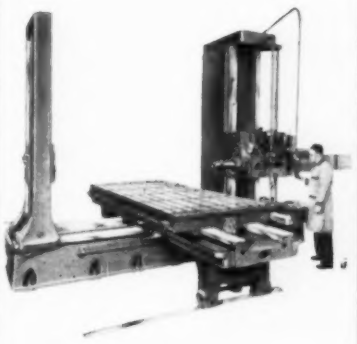
When you are determining the economic justification for a new machine, consider these facts about G&L horizontal boring, drilling, and milling machines:

Accuracy. For example, tolerances of ± .0001″ are being held on dowel spacings in the aluminum transmission housing above. A tolerance of .0005″ is readily maintained on bores.

Machines equipped with the fastest available timesaving automatic electric positioning systems are controlled to predetermined settings within ± .0001″, without final hand adjustments. This is made possible by positioning the table and headstock simultaneously. Addition of the Giddings & Lewis "Lubri-Cool" system, which dissipates heat generated in the machine, assures accurate repeatability all day long.

Versatility. With G&L bar machines, you can handle a tremendously wide range of work, minimize repositioning of workpieces, and frequently handle on the single machine jobs that otherwise would have to be handled on several less versatile machines. They are real metal hogs on heavy die work. They combine the rigidity, power, and ruggedness to take heavy milling cuts on large workpieces. G&L accessories enable them to do turning, boring, backfacing, keyway cutting, and angular milling. Saddle feed can be used for boring operations.

Few machines can give you a comparable return on your investment. For complete information, call your G&L distributor or write.



For accuracy plus versatility: G&L table-type horizontals.

GIDDINGS & LEWIS MACHINE TOOL COMPANY

Fond du lac, Wisconsin

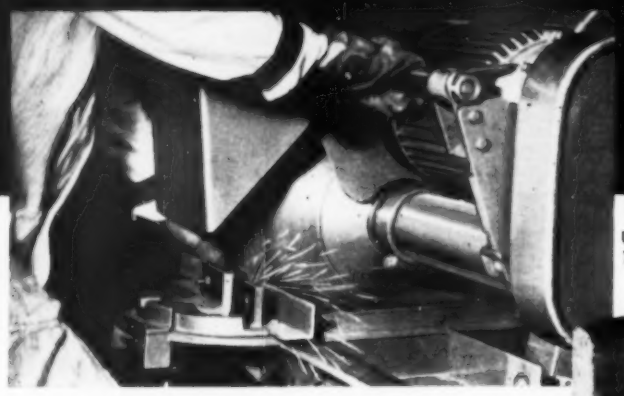
Vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

CIRCLE 276 READER SERVICE CARD

New concept
IN LOW COST CUTTING OF STEEL

PROMACUT

multi-purpose cut-off saw



Model Uni - 8A 10 H.P.

make 10 cuts in 28 seconds
INCLUDING POSITIONING

only 1/5¢ blade cost per cut

The standard PROMACUT unit without extras does any job you're now doing by hacksaw, bandsaw, abrasive or friction cut-off . . . and does it faster, cheaper and more simply. Makes accurate straight and angle cuts, notches, outcuts and incisions—by free-hand or table cutting. Check the quality and savings in features below.

OTHER TYPICAL EXAMPLES OF MAXIMUM SPEED AT MINIMUM COST

Stock (Mild Steel)	Time, Secs. Per Thru-Cut	Min. Cuts Before Sharpening	Blade Cost Per Cut
3/4" dia. Round	0.6	2500	$.0027
3/16" Flat x 7" length	0.9	3400	.0020
2" Square Tube, 1/4" Wall	1.8	2000	.0034
4" dia. Tube, 1/8" Wall	1.2	3600	.0019
3" x 3 1/2" x 3/8" Angle	3.6	1200	.0057

- No coolants needed
- No clamping or hold-down
- Cuts smooth—practically burr-free
- Cuts all shapes of carbon, stainless and alloy steel
- Long blade life
- Cuts 4" angle, 1 1/8" round, 4 1/2" tube, 5" H

WRITE FOR DETAILS . . . ASK FOR MOBILE DEMONSTRATION AT YOUR PLANT

PMI Inc. PRODUCTION MACHINERY INCORPORATED
BALTIMORE • CHICAGO • LOS ANGELES • HOUSTON
P. O. Box 322, Dept. A, Oakton Station, Des Plaines, Illinois

DEALERS: Some territories still open—write on letterhead

Free Literature

To order any of these bulletins, circle corresponding number inside book cover.

matic explanation of the manufacturing method. Request direct on company letterhead.

31 LIQUID POLYVINYL PLASTICS —*Bee Chemical Co, Logo Division, 12933 S Stony Island Ave, Chicago 33, Ill.* 16-page booklet gives information on plastics that set with heat. Liquid plastisol-type plastic, known as Logosol, is described with detailed data on application and use. Material may be used by hot or cold dipping; hollow or solid casting; and knife, roller, or spray coating.

32 CLAMPS—*Sterling Precision Corp, Instrument Division, 17 Matinecock Ave, Port Washington, NY.* 50-page catalog 50 covers complete line of servo clamps for surface mounting motors, potentiometers, synchros. Data sheets include comparison of hardness scales, decimal and metric equivalent of fractions, drill sizes.

33 TITANIUM FASTENERS — *Standard Pressed Steel Co, Box 875, Jenkintown, Penna.* 12-page technical bulletin describes Hi Ti aircraft fasteners and special products. Standard titanium fasteners are shown with military and NAS standard designations. Basic engineering section covers general properties and advantages; compositions of most generally used titanium alloys are given; performance data includes a table of comparative mechanical properties for both steel and titanium bolts.

34 PRECISION LIMIT SWITCH—*R B Denison Mfg Co, 102 St Clair Ave, NW, Cleveland 13, Ohio.* 4-page bulletin M-1 contains description and engineering data on Loxswitch Model M which has been successfully tested to 45,000,000 cycles under electrical load. This small machine tool switch uses a full, heavy-duty latch mechanism, eliminating the use of over-the-center snap springs. Design features and dimensions included.

35 CAM INDEX DRIVES—*Expert Automation Machine Co, 17144 Mt Elliott Ave, Detroit 12, Mich.* Engineering data sheet 150 describes line of standard cam index drives that provide accurate, smooth, rapid, and shock-free indexing of heavy-duty worktables on dial and trunnion-type machine tools. Features, operating descriptions, application data, and dimensioned engineering drawings provided on three models for table sizes ranging from 20 to 100 in. in diameter.

"I brought you something to while away the lonely hours, Floopnik."

36 FLAT SPRING STEEL—*National Standard Co, Atlanta Steel Div, Clifton, N.J.* 28-page catalog 579 presents physical data for users of cold-rolled high-carbon flat spring steels. Includes a consolidated conversion chart showing relationships between Rockwell, Rockwell Superficial, Tukon, and other testers; weight calculation tables and nomographs; sheet metal gage comparison tables; edge specifications; and basic hardness definitions. Typical end products illustrated.

37 NUTS and FASTENERS — *McLaughlin Co, 212 Jaikins Bldg, Birmingham, Mich.* 16-page illustrated general catalog describes complete line of clinch, pilot, and weld nuts in standard and special types. Specifications and applications given, plus reference tables on recommended nut torque and pertinent screw thread information.

38 "KEYS TO BEARING FITS" — *Bearing Inspection, Inc, 3311 E Gage Ave, Huntington Park, Calif.* 8-page manmanual contains instructions on preventing premature bearing failures and off-schedule removals; procedures on obtaining accurate bearing fits easily and economically; engineering data assuring perfect bearing fits on all anti-friction bearings. Installation charts are provided for accurate selection of proper shaft and housing size. ABC method of fit control explained, and use of measuring tools illustrated.

39 STOP NUTS—*Greer Stop Nut Co, 2618 W Flournoy St, Chicago 12, Ill.* 48-page catalog, indexed and illustrated, covers types and sizes; includes hexagon nuts in standard, thin type, flush, flange, double hex, clinch, spline, and instrument mounting. Dimensions and prices included.

40 SPEED CHANGER KIT — *Metron Instrument Co, 432 Lincoln St, Denver 3, Colo.* Data sheet 95 describes new Bantam Kit which permits rapid assembly of 29 speed ratios from parts that may be used repeatedly in different combinations. Ratios provided are from 1:1 to 44:1. Torques up to 130 oz-in. at the low speed shaft and speeds up to 10,000 rpm are handled.

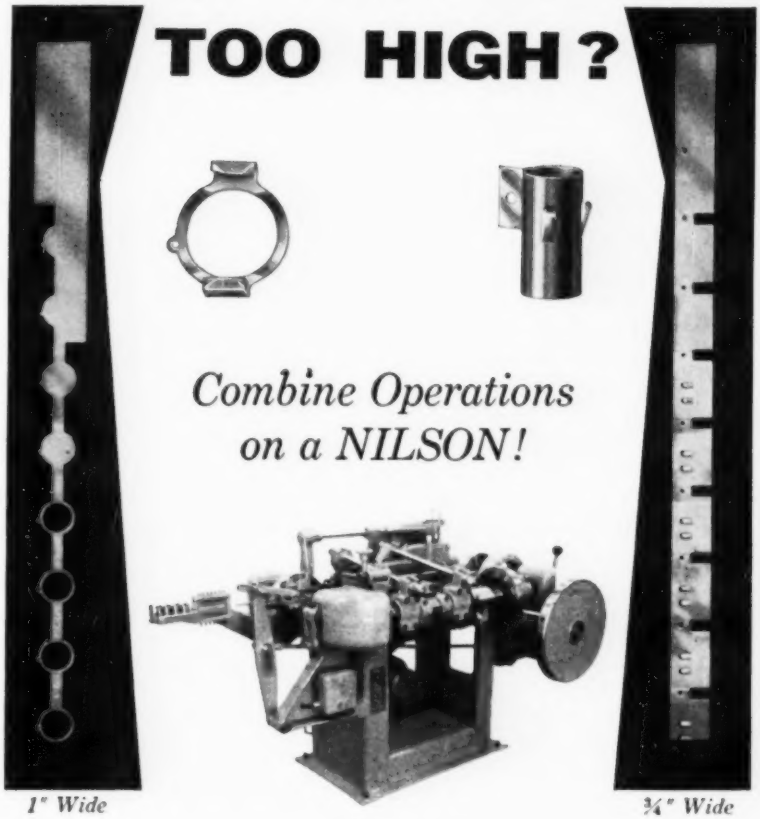
41 POWDER METAL SEAL—*National Sinter-Seal Co, 669 Seneca Industrial Center, Buffalo 10, NY.* Illustrated booklet describes Sinter-Seal, a process developed to combat porosity in powder metal parts. This thermosetting resin is impregnated under vacuum into the pores of parts. It completely penetrates and seals parts pressure-tight and non-absorbing.

● MEEHANITE CAMS, CAMSHAFTS, CRANKSHAFTS — *Meehanite Metal Corp, 714 North Ave, New Rochelle, NY.* 12-page booklet primarily discusses application problems solved by Meehanite products. Also describes the basic metallurgy and important engineering properties of a few types of Meehanite metal most widely used for such service. Request direct on company letterhead.

42 ADJUSTABLE-SPEED DRIVE — *Cleveland Worm & Gear Co, Speed Variator Div, 5500 E 80th St, Cleveland 4, Ohio.* 8-page bulletin K-250 discusses adjustable-speed and drive control problems. Includes typical applications together with methods and types of remote and automatic control, plus variable speed bedplate assemblies.

43 CARBIDE-BONDING METAL — *Powder Alloys Corp, 316 Colfax Ave, Clifton, N.J.* Illustrated literature gives data on Plymet, a new metal that bonds carbide to steel; bond is reportedly stronger than brazing; is shock resistant, and self-fluxing. It is currently available in thin round disks, but can be fabricated to special shapes. Joints have rupture strength in excess of 100,000 psi in comparison with 10,000 to 30,000 psi for brazed carbide joints on comparative tests.

STAMPING COSTS TOO HIGH?



Combine Operations on a NILSON!

1" Wide *¾" Wide*

Stamping costs soar when additional operations must be performed. But a Nilson 4-Slide with built-in press combines stamping *and* forming into one automatic operation . . . no secondary handling . . . ensures product uniformity.

The electronic component shown at left is made of spring-tempered Phosphor bronze, .010" thick. Specifications called for .0002" tolerances on critical dimensions —and allowed a total cumulative error of only .001"!

Solution: A simple progressive die and ingenious 4-slide forming tools are producing this piece at the rate of two finished parts per second. Production costs are substantially lower than if tooled for a conventional press.

With *nine* standard working motions available on a Nilson 4-Slide, production performance is limited only by the ingenuity of the tool designer!

If you produce wire forms or small metal stampings, Nilson's 4-slide forming techniques can point the way to lower costs. Send prints or sample parts for engineering recommendations.

Write today for the Nilson General Catalog on Automatic 4-Slide Equipment.

Parts & production data, courtesy of Plaza Tool & Die Corp., Long Island City, N.Y.

NILSON
THE A. H. NILSON MACHINE CO.
601 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

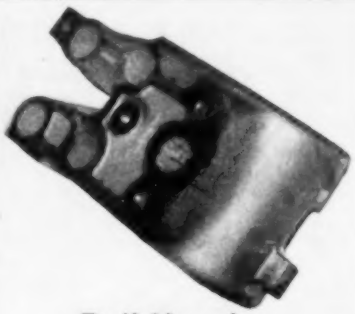
Mattison surface grinders outproduce cutter-type machining on parts like these

Stop Lever Bracket

MILL	GRIND
58 min	44 min

Table Guide

MILL	GRIND
12 min	4½ min



Roll Housing

MILL	GRIND
16 min	11 min

Motor Base Plate

PLAIN	GRIND
82 min	57 min

Lock Bar

MILL & GRIND	GRIND
44 min	24 min

Feed Control Plate

MILL & GRIND	GRIND
35 min	20 min

Table Guide

MILL	GRIND
16 min	9 min

Roll Housing

MILL	GRIND
17 min	11 min

CONTINUOUS CUTTING ACTION SAVES MONEY

These jobs show how high-powered surface grinders speed stock removal (up to ¼ in. per side is economical) . . . with improvements in finish and accuracy. Real savings come from reduction or elimination of: scrap, downtime for tool changing and sharpening, setup time, fixture costs, and tool breakage. Ask for a test grind of your parts in our Methods Lab.

MATTISON MACHINE WORKS
Rockford, Illinois Phone WOodland 2-5521

MATTISON
MACHINE WORKS

HIGH-POWERED
PRECISION
SURFACE GRINDERS

Paul W Leming (left) has been named head of the Van Norman Machine Co. New firm is the result of consolidation of the Van Norman Machine Tool Co and Van Norman Automotive Equipment divisions of Van Norman Industries. Mr Leming was formerly executive vice president of Van Norman Machine Tool Co. **Selby F Greer,** automotive equipment executive associated with the organization since 1950, has been named executive vice president in charge of sales for the new firm

NAMES IN THE NEWS...

Wilbur E Lunger has been elected staff vice president of manufacturing, and **H Ben Young** staff vice president of engineering and research of ACF Industries, Inc. Both men were officers in ACF operating divisions; Mr Lunger has been serving as vice president of manufacturing at the American Car and Foundry Division in New York, and Mr Young as director of engineering and research at the W-K-M Division in Houston, Texas.

Russell E Skinner has been named manufacturing manager for Ford Motor Co's Indianapolis Steering Gear and Cold Heading Plant. He was previously manager of the manufacturing and plant engineering department at the company's Canton (Ohio) Forge Plant.

Vincent W Stehlin, purchasing agent and assistant general manager of the Fosdick Machine Tool Co, Cincinnati, has been appointed assistant purchasing agent for R K LeBlond Machine Tool Co, parent company. **Charles A DeVries,** Fosdick plant engineer, has been named purchasing agent and assistant to the president of Fosdick.

George E Beggs Jr, assistant to the president of Leeds & Northrup Co, Philadelphia, has been elected executive vice president of the company. **Daniel H Schultz** has been named senior vice president succeeding **C Reed Cary,** now board chairman.

Kimball C Cummings has been named manager of engineering of Minneapolis-Honeywell's Beltsville, Md, division. He was formerly associate director of research at the company's Aeronautical Division.

Herbert A France Jr has been appointed manager of quality control for Pratt & Whitney Co, West Hartford, Conn.

M Victor Hopkins has been appointed superintendent of GM's Fisher Body Division assembly plant at Willow Run, Mich. He was previously chief inspector of the assembly section at the Fisher Body plant No. 1 in Flint.

Edward R Burkardt has been elected vice president in charge of tool sales of J H Williams & Co, Buffalo manufacturer of wrenches, tools, and drop forgings. Formerly sales manager of the company's tools division, he succeeds **John B Perkins** who has retired after 45 years with the organization.

James L Molnar has been appointed production body engineer of American Motors Corp. Formerly assistant, he replaces **Wallace H Jerstad** who has retired after 37 years with the company.

S J Becker has been named vice president and chief engineer of Borg-Warner Corp's Spring Division at Bellwood, Ill. He has been associated with the division for 19 years.

Wesley A Songer has been elected executive vice president of Crane Co, Chicago manufacturer of valves, fittings, plumbing and heating equipment. He was formerly executive vice president of American Safety Razor Corp.

Victor Frederiksen has been appointed to the central staff of Detroit Harvester Co as manufacturing engineer. He will operate on special assignments throughout the company's manufacturing divisions. Prior to joining the company Mr Frederiksen was manufacturing manager at the Richmond Drill Division of Bucyrus Erie Co, Richmond, Ind.

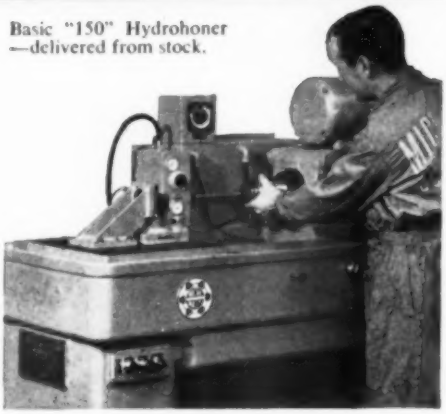
John W Carlson has been named general manager of Allis-Chalmers' Deerfield Works. Mr Carlson was formerly president of Tractomotive Corp, Deerfield, Ill. The company was recently acquired by A-C and

W J Smetak (left) will serve as president of the merged Wm K Stamets Co, Pittsburgh, and its subsidiary, the Enterprise Co, Columbiana, Ohio. Company designs, builds, and distributes machine tools and special machinery and will continue as the Wm K Stamets Co. The operation at Columbiana will be known as the Enterprise Division. The Standard Machine Tool Distributor Division will continue in Pittsburgh under **Henry R Hanson** as vice president and manager

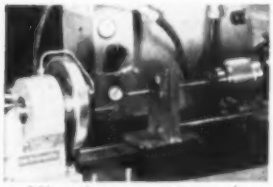
WHY "150" HYDROHONER

Reduces Costs . . .
Assures Controlled Finish . . .
Provides Rapid Stock Removal

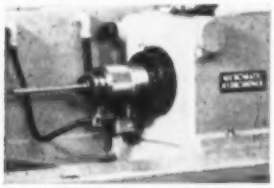
To assure rapid stock removal and consistent generation of surface finish desired, the low-cost "150" Hydrohoner utilizes the distinctive Microhoning characteristic of self-dressing abrasives. Because abrasive grits are kept sharp-cutting at all times by a combination of controlled pressure and reciprocating-revolving motions of tool, a constantly high cutting efficiency is effected.



Basic "150" Hydrohoner —delivered from stock.



Microsize gage automatically ends cycle when exact size is reached.



Microdial automatic feed control and stone wear compensation.

Possessing a 12-inch stroke and a work diameter capacity of 1½ inches, the standardized "150" readily accommodates a variety of fixturing and tooling to assure easy adaption to a wide variety of work parts. Also, by addition of standard packaged units produced by Micromatic, it can be partially or fully automated.

Performing to the standards of higher-priced, special-purpose honing machines and incorporating features of a general-purpose design, the "150" Hydrohoner is an economical, long-range investment for long or short production runs.

Send Coupon for Complete Information.

Learn why Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____ J

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NAMES IN THE NEWS . . .

is now, as the Deerfield Works, part of A-C's Construction Machinery Division. **Kenneth J Qualman** has been appointed works manager of the Wauwatosa Works. He had been plant manager of the newly acquired facilities, formerly the Lakefield Manufacturing Co, Wauwatosa, Wisconsin.

William D Wallace, director of manufacturing at Crown Cork & Seal Co, Philadelphia, has been elected vice president and director of operations. **Lowell H Smith,** also named a vice president, will continue as general manager of Crown's Machinery Division. **John L Carnie,** general manager of can operations, succeeds Mr Wallace as director of manufacturing.

Edward E Bickel, optical engineer, has been made vice president, engineering, of Simpson Optical Manufacturing Co, Chicago. **William T Strickland Jr,** plant manager, has been promoted to vice president, manufacturing.

James P Coughlin has been appointed vice president, sales, of American Hard Rubber Co. He was formerly manager of the Electric Arc Welding Division of Westinghouse Electric Corp.

Sydney M Stoller, engineering manager, and **Jack L Schumann,** sales manager, have been named vice president engineering, and vice president sales, respectively, at Vitro Engineering Co, New York, a division of Vitro Corp of America.

John M Van Dam has been appointed general manager of Aeroquip Corp's General Logistics Division, Burbank, Calif, producer of load control and cargo tiedown equipment for aircraft and industrial uses. He was previously manager of materials at Westinghouse Electric Corp's Aviation Gas Turbine Division, Kansas City, Mo.

George H Malony has been named assistant sales manager of the Whitman & Barnes Division of United-Greenfield Corp, Plymouth, Mich. He succeeds **E S Anderson** who has retired.

George F Halfacre has been elected vice president, manufacturing, of the New Jersey Zinc Co. Formerly manager of manufacturing, he succeeds **Philip M Ginder** who has retired.

Robert L Groves has been appointed administrative assistant, sales department, at Warner & Swasey Co, Cleveland. Formerly European district manager for the company in Paris, Mr Groves will concentrate on machine tool sales activities.

John R Bossenga has been appointed assistant to the chief engineer of SpeedWay Manufacturing Division of Thor Power Tool Co, LaGrange Park, Ill. **Ernie C Rangus,** chief draftsman, has been promoted to production and tooling engineer.

Walter Hasenzahl has joined Avco Corp's Crosley Division as director of manufacturing engineering. He was formerly associated with the Clyde Division of Whirlpool, Inc, Clyde, Ohio, as director of technical services in charge of manufacturing research and development. **George L Schafstall,** formerly controller of the Crosley Division, has been named director of purchasing.

B W Moreland has been elected vice president of Copeland Refrigeration Corp, Sidney, Ohio. He will continue to head manufacturing operations.

William J Bradley has been appointed factory manager of Superweld Corp, North Hollywood, Calif, high-temperature brazing concern. Prior to joining the company Mr Bradley was general manager and chief engineer in charge of product design for Earth Equipment Corp of Los Angeles. **Kenneth L Madden** has been named manager of quality control at Superweld. He was formerly plant manager, Electronic Welding Co.

Leland E Bruce, staff engineer, has been advanced to assistant production manager of the Chemical Milling Division of US Chemical Milling Corp, Manhattan Beach, Calif.

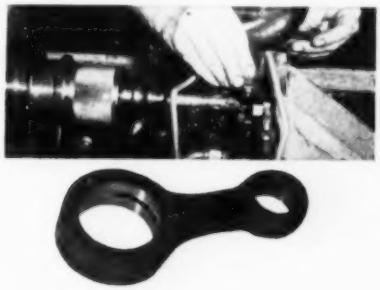
Robert R Ashley has been appointed manufacturing manager of the Stratford, Conn, plant of the Detroit Controls Division of American Standard. He was formerly foundry manager for the Schaible Division at Cincinnati, Ohio.

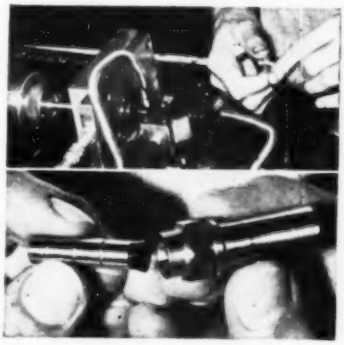
Fred C Emerson, vice president and sales manager of Spartan Saw Works, Springfield, Mass, has been elected president of the American Supply and Machinery Manufacturers' Association. **Samuel D Conant,** Jacobs Manufacturing Co, West Hartford, Conn, was elected first vice president of the Association, and **Paul A Johnson,** Dake Corp, Grand Haven, Mich, second vice president.

HOW Manufacturers Use "150" HYDROHONER To Reduce Costs...Control Finish... Obtain Rapid Stock Removal

Leading Manufacturers of precision parts are using the low-cost "150" Hydrohoner to secure high production, rapid stock removal, geometrical precision and controlled surface finishes. Indicative of the versatility for application of this highly efficient honing machine are the following recent installations:

The crankpin bore of a compressor connecting rod is Microhoned on a "150" Hydrohoner within tolerances of .00015" for taper, and .0002" for size and out-of-roundness. From .0008" to .001" of stock is removed from the bore (.875" diameter x .43" long) in about 8 seconds, while obtaining an 8 Microinch finish.





In this installation, a "150" is Microhoning in two runs the bore (.313" diameter x 1.375" long) of a braking cylinder. The first run removes between .004" and .006" of stock in 30 to 35 seconds. During finishing run, the final .0005" to .0008" is removed to provide geometric accuracy within .0002" tolerance and an 8 Microinch or better finish. Precision and controlled finish of bore prevent hydraulic oil leakage and minimize wear of neoprene-cupped piston.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
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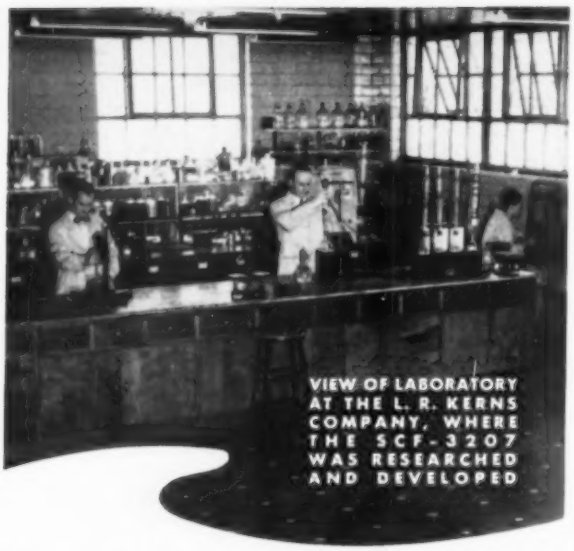


VIEW OF LABORATORY AT THE L. R. KERNS COMPANY, WHERE THE SCF-3207 WAS RESEARCHED AND DEVELOPED

New Soluble Cutting Fluid replaces straight cutting oils

RESEARCHED 11 YEARS

Kerns' new SCF-3207 is the result of 11 years of extensive research and development. It's the greatest advancement in cutting fluids in the last fifty years and is designed to replace cutting oils in up to 90% of all types of machining operations. SCF-3207 is a water emulsifiable, heavy duty, cutting oil base containing high percentages of extreme pressure and anti-weld additives.

CUTS COST AND INVENTORY

Kerns' new SCF-3207 is actually 25% less expensive than the lowest priced straight cutting oils and cuts inventory and warehouse requirements. Only 5 drums of Kerns' SCF-3207 equals 50 or more drums of straight cutting oil.

SAFE...CLEAN

Absolutely no dermatitis . . . positively no rancidity. Can be used with absolute safety in any type of machine tool and due to lighter viscosity there is less carry off. Parts are cleaner, cooler, easier to handle.

MEMO BILLING TRIAL BASIS

Try it, prove it to yourself . . . take advantage of our Memo Billing Trial Basis Policy. We supply sufficient quantity of SCF-3207 to conduct a comprehensive production run test, no formal invoice rendered unless completely approved in production.

Write for further information and Technical Data Sheet SCF-3207

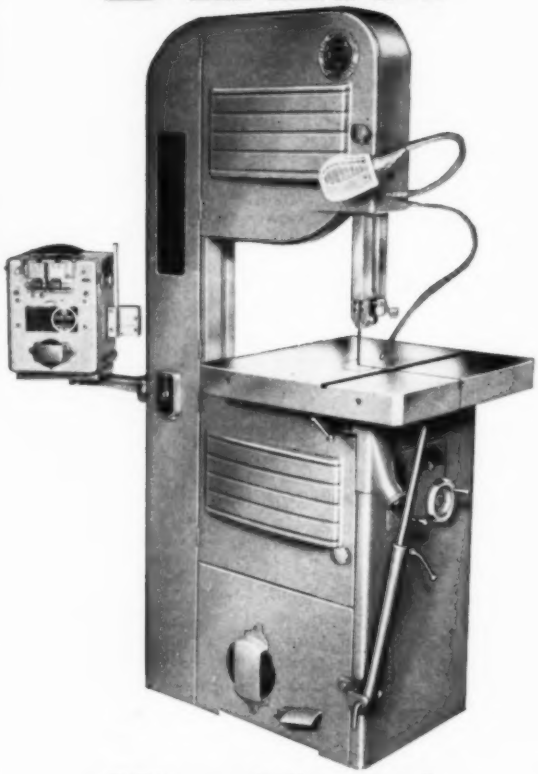
QUALITY SERVICE

L.R. Kerns Co.

2880 EAST 80th STREET • CHICAGO 17, ILL.

Subsidiary Plant
KERNS PACIFIC CORPORATION
630 N. Batavia Street • Orange, California

NEW from DELTA



20" metal-wood

Variable Speed

BAND SAW

Now you can have the Band Saw features you said you wanted most—*and for less than $900!* This all-new Delta Band Saw (shown with optional blade welder) gives *greater accuracy, better cutting performance* with:

WIDE RANGE VARIABLE SPEED DRIVE—50 to 4500 FPM—cuts stainless steel, aluminum, wood, plastics.

SCIENTIFICALLY DESIGNED BLADE GUIDES—give maximum blade support for heavy metal cutting.

RUGGED FRAME CONSTRUCTION—massive, rigid internal frame with modern fabricated exterior.

SEE IT AT YOUR NEAREST DELTA DEALER—he's listed under "TOOLS" in the Yellow Pages—or write: Rockwell Manufacturing Company, Delta Power Tool Division, 618G, N. Lexington Ave., Pittsburgh 8, Pa.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

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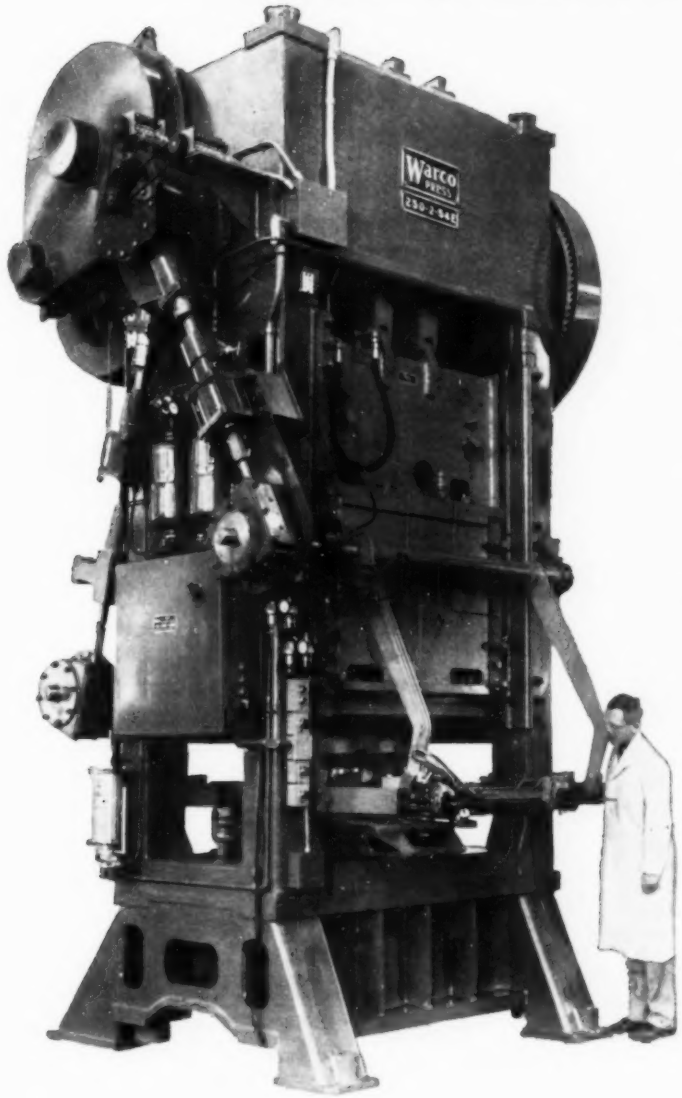
Warco automation



You can expect mechanical presses of unsurpassed quality when you specify Warco, for every Warco press is designed and custom built with machine tool precision. The result: Warcos work better, faster—with substantially reduced maintenance.

This typical Warco 250 Ton Double Eccentric Shaft Straight Side Press is being used by a leading farm equipment manufacturer to automatically feed and *hot form* the camber and accurately punch and countersink bolt holes in heavy gauge plow shares, discharging them automatically into a heat treating bath. Press slide incorporates a hydro-pneumatic overload device.

If you're considering press equipment, remember . . . if you want maintenance-free quality—you want Warco.

Federal® WELDERS

Warco PRESSES ®

THE FEDERAL MACHINE AND WELDER COMPANY • WARREN, OHIO

A Grieder Tube Cut-Off Machine will produce 4500 to 6500 cut-offs per hour

Grieder Tube Cut-Off Machines are 3 to 8 times faster than others, and speed is only one of the cost saving advantages they provide. For example:

- $ Cut tubing of any shape to any length—steel, copper, brass, aluminum and alloys. Continuous automatic operation.
- $ Lengths can be held to plus or minus .002" on light wall tubing and to .003" on heavier.
- $ Precision clamping dies prevent tube distortion and produce a quality cut. Tube does not rotate.
- $ Thousands of cuts without grinding. Blades can be sharpened on standard tool room equipment and used for as many as a million cuts.

Write for literature, stating tube sizes and production requirements.

GRIEDER INDUSTRIES, INC.
P. O. Box 169 • Bowling Green, Ohio

Please send bulletin describing Grieder Tube Cut-Off Machines.

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COMPANY _____
CITY _____ ZONE _____
STATE _____

Grieder
TUBE CUT-OFF MACHINES

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THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade was developed to cut any material from the free machining steels to the toughest alloys, fast, accurately and economically. Just one type blade to handle any job—no switching blades to cut different materials.

MARVEL blades can be tensioned from 200% to 300% more taut than ordinary blades. This advantage permits heavier feed pressures to be used without deflection or fear of breakage.

This rugged cutting tool assures outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

Ask for MARVEL Blades by name and you can be sure you're getting the best. Leading Industrial Distributors have them in stock. Write for latest Cutting Tool Bulletin. FB-1021

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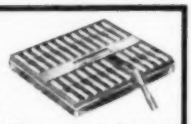
5700 W. Bloomingdale Ave., Chicago 39, U.S.A.
Manufacturers of the Outstanding MARVEL Metal Saws

U.S. Patent 2,715,281

DELTRONIC
TENTH PLUG GAUGES

Precision lapped—(under 120, superfinished). Cold stabilized. Sets incl nom. plus 12 wp, 12 down, in .0001 steps. Double ended, double wear. IDEAL FOR: Machining, Inspection, Boring, Toolmaking, Honing. Off shelf delivery. Stocked in most principal cities.



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MONEY BACK GUARANTEE

Write for FREE sample ¼" gauge, and suggested uses. Dealer inquiries solicited.
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Stops Losses making Dies and Templates

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END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

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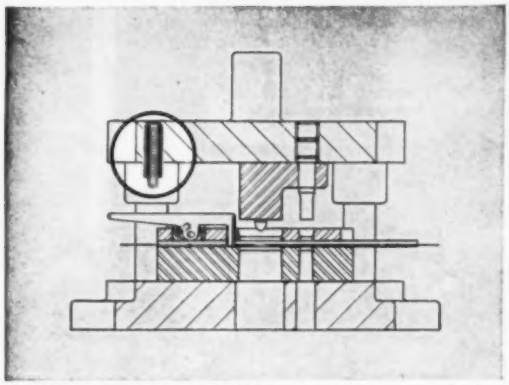
CIRCLE 289 READER SERVICE CARD

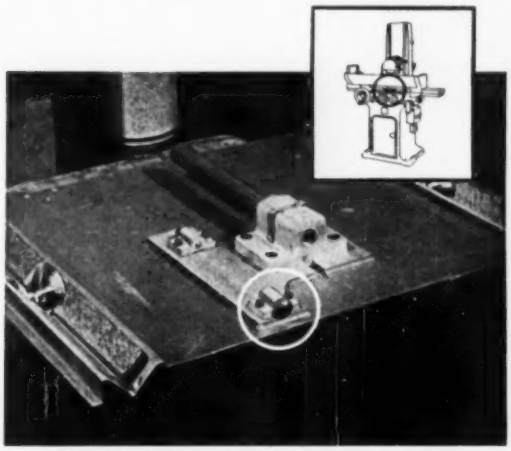
Practical Tooling Tips

Number 2 of a series.

Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.

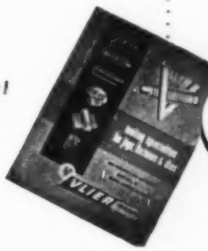


TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.

TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the *standard* Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

TO GET NEW IDEAS on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

New catalog now ready! Send for your copy today.



Insist on Vlier Tooling Accessories... there's still no substitute for quality!

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Revolutionary new grinding and sharpening method! In one setting and in one operation the pilot and the relief angle can be ground. Any required pilot. Standard drills made into pilot drills fast and economically!!

also Counterboring

Two, three and four lip drills with any required cutting lip angle can be ground in one operation and in one setting. Special dressing device for profiling the grinding wheel available.

also Multiple Step Drillings

Fast and simple setting for grinding multiple step drills using standard two-lip or three-lip drills. Accurate pilot diameters and pilot lengths obtainable with dial indicator set-up.

Ask for detailed information on the new.

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Modell N 4-90 Z

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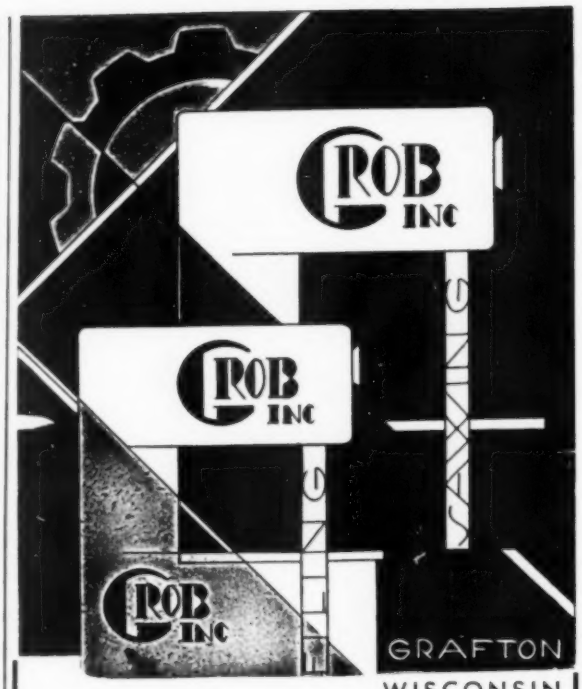

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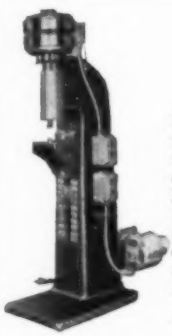

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RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

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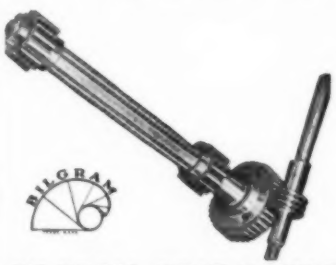

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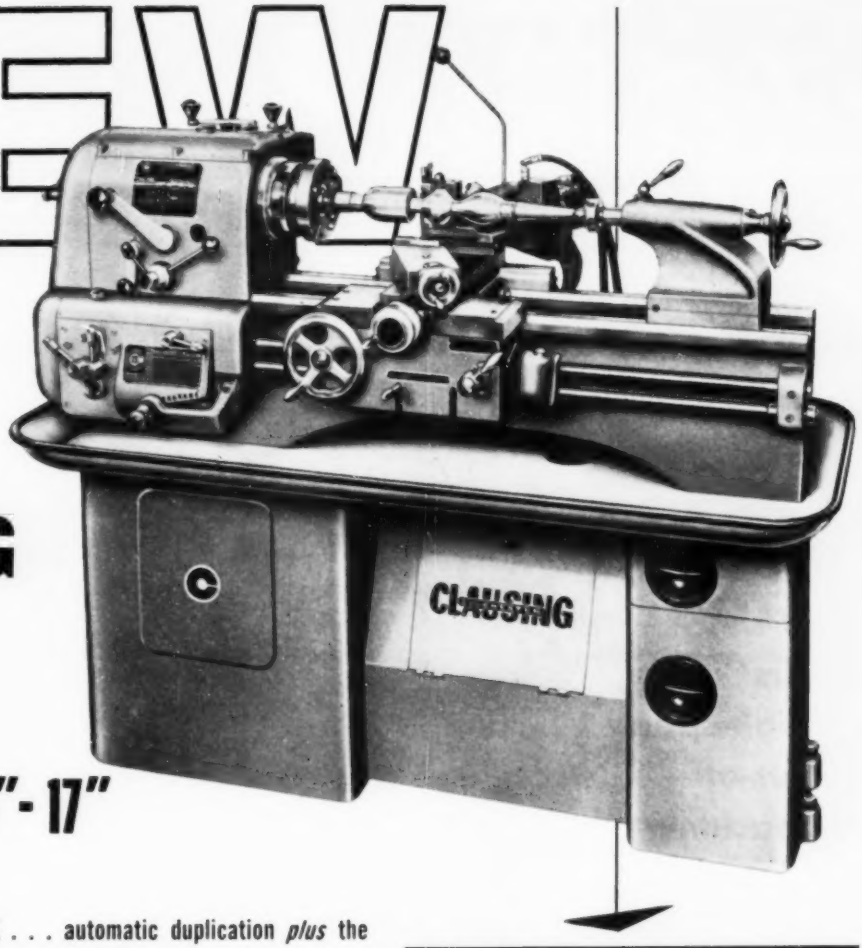


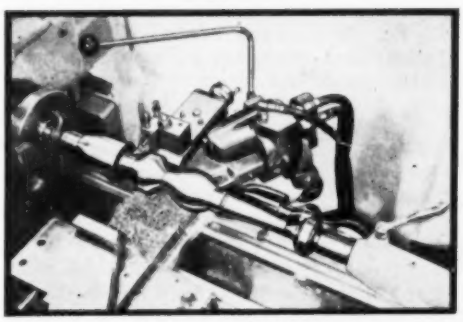
CLAUSING COLCHESTER HYDRAULIC PROFILING LATHES - 13" - 15" - 17"

TWO MACHINES IN ONE . . . automatic duplication *plus* the versatility of a standard geared-head lathe!

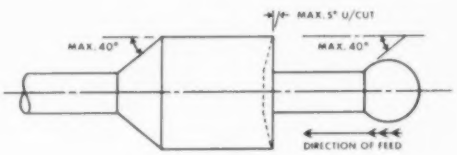
With the new Clausing-Colchester profiling lathes you can machine multiple diameters, tapers, 90° shoulders, bevels, radii, grooves, chamfers and undercuts to the same accuracy as the template — saving time, money, and eliminating rejects. Moving the hydraulic control lever engages tool with work or withdraws it for standard lathe operations — there's no loss of time shifting from one machining function to another.

Profiler tool slide and hydraulically operated angle slide are mounted on rear of carriage cross slide, with hydraulic slide 60° to axis of lathe bed. Angle slide is powered by an integral hydraulic cylinder. Support centers for templates are mounted at rear of lathe bed. Motor, pump, and reservoir are integral.

Lathe features include: big work capacities with large spindles, Gamet Micron tapered roller bearings with oil flow lubrication, tapered key-drive spindle nose, enclosed geared headstock and quick-change box with oil-bath lubrication, hardened bed ways. Write for illustrated literature.



Maximum profiling capacities of Clausing geared-head lathes are indicated below.



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FASTEST

CUT-OFF MACHINE on the MARKET

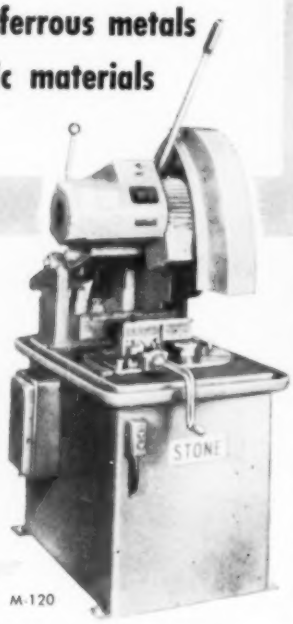
less than

4 SECONDS PER SQUARE INCH

on ferrous & non-ferrous metals and non-metallic materials

STONE

First in high-speed cut-off machinery



Model M-120

For close tolerance cuts on bars, pipe, tubing, sheet, plate, structurals and extrusions, Stone cut-off machines deliver production-line speed, plus a mill-like finish. There's a complete line of chop-stroke, double-miter, and travers type cut-off machines from 3½ to 15 H.P. with a wide range of gear ratios to assure proper spindle speeds. They may be equipped for manual, semi-, or fully-automatic operation. Oil Mist Spray, for non-ferrous cutting, lengthens the life of the blade and contributes to finer finish.

Typical of Stone's dependable construction, the M-120, illustrated, features a fully-enclosed, 10 H.P. geared-in-head motor, that delivers maximum power to the cutting edge; a fast-acting, large capacity, self-centering vise, adjustable for angle cutting and a heavy, cast table-surface, machined for use with jigs and fixtures. On production lines requiring fast, heavy-duty cutting, the M-100 may be equipped with automatic bar-feed to deliver up to 1600 cycles per hour.

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Full details, plus illustrations of the complete line of Stone metal cutting machinery. Write for your copy today.

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"... represented in every major industry throughout the world"

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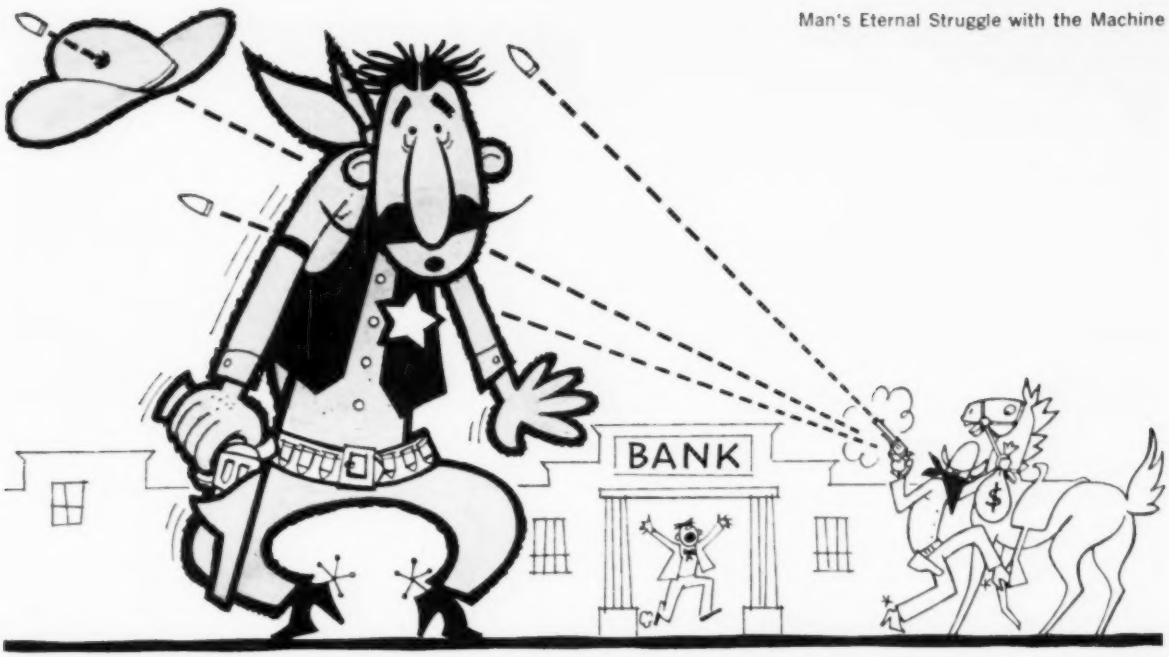
Man's Eternal Struggle with the Machine



COMPETITIVE PRESSURES AND RISING COSTS DEMAND GREATER PRODUCTION EFFICIENCY THAN EVER BEFORE

Have you ever wished you worked in a nice, quiet little shop...?

Sure you have.

The chances are you don't work in one now. There just aren't any nice, quiet little shops anymore. Everybody's out to make a buck. And they all seem to be competitors of yours.

Like everybody else's, your shop is full of complex equipment. Production is rough on the best of it. Eventual breakdown of some sort is almost inevitable. Even though your maintenance people can satisfy most of the problems, what happens when something goes wrong they can't handle?

With your production held up by a breakdown, you can't afford a vendor who passes the buck for service to all the suppliers of his components!

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Why take less than the full advantage of consulting with a Sciaky Application Engineer the next time you're considering equipment. No obligation, of course.

Sciaky Service is a plus-feature that has been wanted by customers all over the world. Why take a chance on service that's sometimes needed on even the best machines. Why, to be sure, when you can enjoy the service facility that has been the difference between expensive production stoppages and minor delays.

SCIAKY

75A

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Who Discovers the Discoverers?

"A professor can never better distinguish himself in his work than by encouraging a clever pupil, for the true discoverers are among them, as comets amongst the stars." CARL LINNAEUS

Somewhere in this mighty land of ours, a gifted youth is learning to see the light of tomorrow. Somewhere, in a college classroom or laboratory, a dedicated teacher is gently leading genius toward goals of lofty attainment. Somewhere the mind of a future discoverer—in science, engineering, government, or the arts—is being trained to transcend the commonplace.

Our nation has been richly rewarded by the quality of thought nurtured in our colleges and universities. The caliber of learning generated there has been responsible in no small part for our American way of life. To our college teachers, the selfless men and women who inspire our priceless human resources, we owe more than we will ever be able to repay.

Yet how are we actually treating these dedicated people? Today low salaries are not only driving gifted teachers into other fields, but are steadily reducing the number of qualified people who choose college teaching as a career. At the same time, classrooms are beginning to get overcrowded. In the face of this, college applications are expected to double by 1967.

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KEEP IT BRIGHT

If you want to know more about what the college crisis means to you, and what you can do to help, write for a free booklet to: HIGHER EDUCATION, Box 36, Times Square Station, New York 36, New York.

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2. Automatics
5. Bolt Machines
6. Boring Mills
7. Broaching Machines
9. Centering Machines
10. Chucking Machines
11. Compressors
16. Drilling & Reaming Machines
23. Gear Cutting Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
40. Press Brakes
41. Presses
45. Riveting Equipment
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50. Shapers
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55. Thread Grinders
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58. Welding Equipment

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"No Cost or Obligation"

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

How to use: Check the dealer ads to see if what you want is not currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist
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Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

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7/27/59

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SALES MANAGER

Machine Tool Company seeks experienced sales manager to implement nation-wide sales program. First rate, well established and newly developed machines with tremendous sales potential. Applicants must have technical background, national marketing experience and sufficient ability to justify very high earnings.

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If you have experience and technical knowledge and good contacts in your territory, a machine tool company with first class equipment will finance you to become an independent dealer in your hometown. In first letter indicate territory covered, experience in types of machines, yearly gross sales obtained. All replies strictly confidential.

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No. 2L Gisholt, m.d.
No. 2MB, Libby, 1942
No. 3 Gisholt, m.d., 1945
No. 3A Warner & Swasey, m.d.
No. 3 Bardons & Oliver Ram Type, flanged m.d.
No. 3L Gisholt, m.d., 1943
No. 3AL Gisholt, with cross sliding turret, 1940
No. 4 Midland Universal Ram Type, m.d.
No. 4 Warner & Swasey Universal Ram Type, m.d.
No. 4 Gisholt, 1943
No. 4A Warner & Swasey Universal Hollow Hexagon, m.d.
No. 4A Warner & Swasey Universal, m.d., chucking, 1939
No. 4L Gisholt Universal, m.d.
No. 4FU Foster Fastermatic, m.d., latest, 1945
No. 4H-12 Libby, m.d.
No. 4R Libby Ram Type, m.d. in base
No. 5 Midland, m.d.
No. 5 Gisholt, Ram Type, m.d.
No. 5L Gisholt, 1946
No. 6.2 Denver Acme Ram Type Universal, m.d., 1944
No. 7 Bardons & Oliver, m.d.

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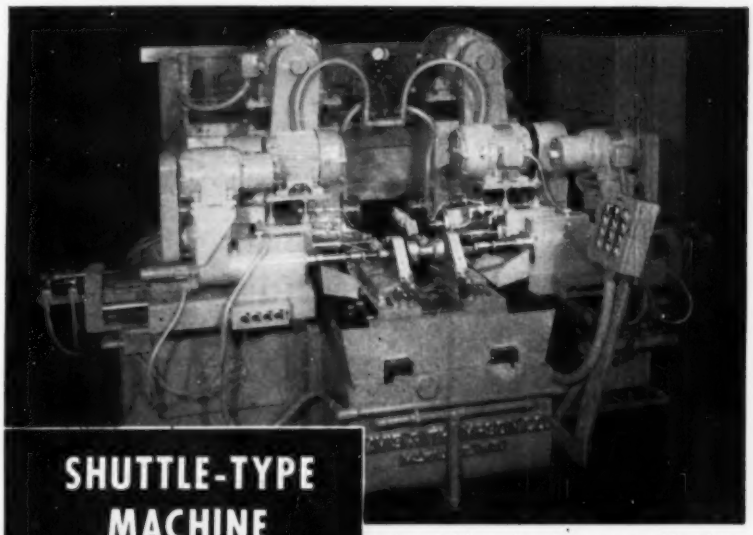

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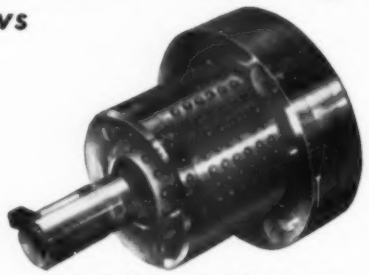

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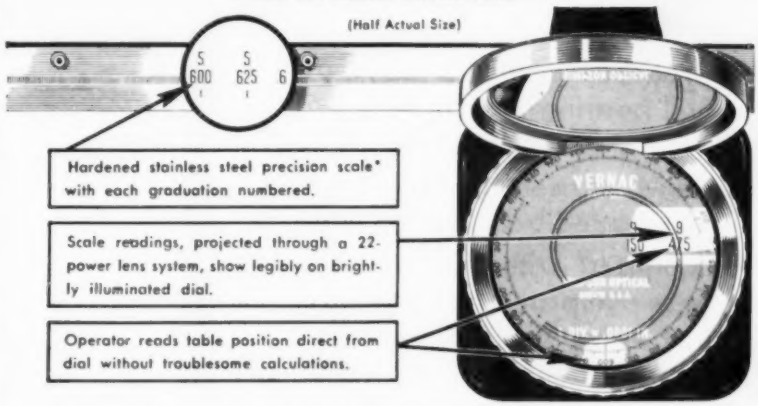
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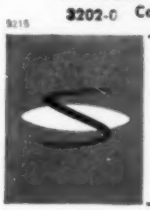

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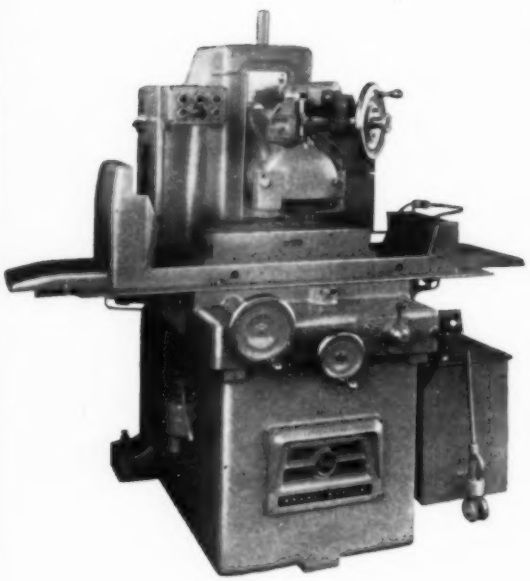

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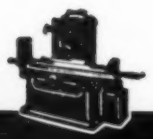

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20	42	64	86	108	130	152	174	196	218	240	262	284	306	328	350	372	394	416	438	460
21	43	65	87	109	131	153	175	197	219	241	263	285	307	329	351	373	395	417	439	461
22	44	66	88	110	132	154	176	198	220	242	264	286	308	330	352	374	396	418	440	462

INSIDE FRONT COVER

INSIDE BACK COVER

BACK COVER

SEARCHLIGHT SECTION

Surplus	Used and Rebuilt	Equipment
500	507 514	521 528
501	508 515	522 529
502	509 516	523 530
503	510 517	524 531
504	511 518	525 532
505	512 519	526 533
506	513 520	527 534

Name_____

Title_____

Company Name_____

Address_____

City, State_____

more data?

it's easy

1. Circle Key Number(s)
on these cards that
correspond(s) to number(s)
at bottom of advertisement(s),
new equipment item(s)
or catalog(s) offered

2. Print clearly . . .
name, title, company name and address

3. Tear Off and Mail . . .
We'll do the rest

Use these time-saving cards to keep up-to-date with the metalworking industry

Swingline #101 Staple Gun

The Tool of a 1000 Uses.

FRONT and BACK views of #101 Staple Gun base.

Swingline INC.

Manufacturers of staplers, staples & office specialties

Swingline, Incorporated, represents another example of the reliance successful manufacturers place upon U. S. Press Room Equipment.

In the manufacture of their "Swingline No. 101 Staple Gun" Swingline utilizes the U. S. team of "Cradle to Straightener to Slide Feed" — a perfectly matched combination.

Swingline, in the production of their 101 Staple Gun, fabricates the 101 base from .062" coil stock, 1.468" wide. Stock is unwound from a model ACC-1-9C U. S. Multi-Roll Cradle. From the Cradle, stock leads into a model SS-27 U. S. Plain Stock Straightener which removes coil set. The stock is drawn through the Plain Straightener by a model SF-68A U. S. Slide Feed and accurately fed to the press with a feed stroke of 5⅜", at a rate up to 4000 per hour. This particular U. S. Slide Feed has a maximum stock width capacity of 6" and a maximum feed length adjustable up to 8".

As it has for Swingline and many other manufacturers, U. S. Press Room Equipment can help you to produce a fine product, economically. If yours is a press room production operation, get the complete story about U. S. Press Room Equipment by sending for Bulletin No. 85A.

TURNS TO U.S. PRESS ROOM EQUIPMENT

U. S. TOOL COMPANY, INC. AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

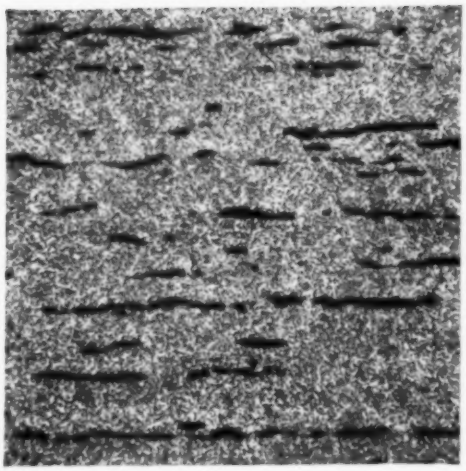
MULTI-SLIDE

CIRCLE 162 READER SERVICE CARD

Why GRAPH-MO® is best steel for gages and dies...

GREATER WEARABILITY

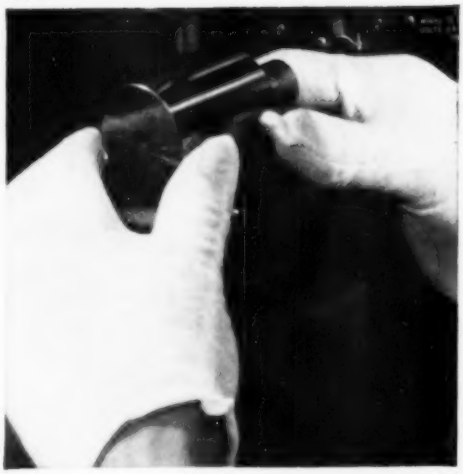
You get a steel that wears longer when you use Graph-Mo®. Reports from users show that Graph-Mo outwears ordinary tool steels 3 to 1! That's because of the combination of free graphite particles and diamond hard carbides in the Graph-Mo structure. You can see them in the photomicrograph at right.



100 X

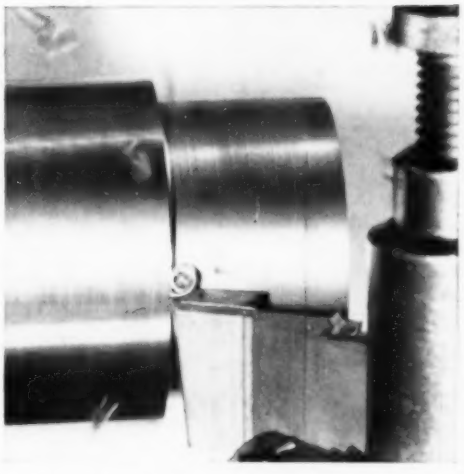
BETTER STABILITY

You get a steel that keeps gages and dies accurate longer when you use Graph-Mo. Tests prove its stability. For example, a typical master plug gage (see photo, right) made of Graph-Mo showed less than 10 millionths of an inch change after 12 years of use. Graph-Mo is the most stable gage steel ever made.



FASTER MACHINABILITY

You save machining time with Graph-Mo. It out-performs ordinary tool steels on the Constant Pressure Machinability Tests. Graph-Mo machines 30% easier. Notice short chips in the photo at right. The free graphite in its structure enables you to make tool steel parts faster. Yet with all its advantages, *Graph-Mo costs no more than other oil hardening tool steels.* For time-and-money-savings, better finished products, specify Graph-Mo. There's only one Graph-Mo, and the Timken Company makes it. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*



WHEN YOU BUY TIMKEN STEEL YOU GET...

1. Quality that's uniform from heat to heat, bar to bar, order to order
2. Service from the experts in specialty steels
3. Over 40 years experience in solving tough steel problems

TIMKEN® *Fine Alloy* STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CIRCLE 163 READER SERVICE CARD